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The most striking feature in the railroad situation of the country, viewed on its financial side, is its reversion, during the last few weeks of stress in the money market, from abnormal to normal symptoms with the inexorable laws of political economy now asserting themselves. Men were wondering a few months ago at steadily falling prices of railroad securities in the face of a great volume of business and increased railroad earnings, both gross and net, coupled with a general condition of prosperity throughout the country, and actual failures few and insignificant. Corporation "baiting" but partly explained the anomaly. It was an element, but an insufficient cause. But a brief period of semi-panic has brought us back to the natural and logical sequels of such a period. Prosperity has somewhat receded. Railroad earnings have dropped in gross, and roads not returning a positive decrease have failed to maintain a normal gain; and net earnings, owing to rise of operating expense, have decidedly fallen. The two things that differentiate the situation from earlier epochs of sudden depression are, first, its impact at a time of high expense and large loans for improvements, and, secondly, its recovering just after a general increase of railroad wages. The problems ahead are: how can improvements be held up or curtailed? how can imperative improvements be financed? and how can fixed charges and dividend requirements be met without the risk of labor troubles by reducing wages at a time when labor is highly organized and assertive. But the gloom is far from encircling, and rational optimism has also its kindly lights. It can point to financial conditions at the New York center oscillating upward where they were lately downward; to the few defaults in interest and dividends and only a small proportion of those defaults in railroads; to the fact that past prosperity has also made operating economy more feasible in such matters, for example, as more concentrated train service; to the facts that, even if later the question of reduced wages must be faced, it will be after labor has had its warnings and may be amenable to a situation, if not to reason, while the halting of improvements is far easier when the traffic that calls for them is ebbing than when traffic is "balled up" for lack of rolling stock or a second track. Finally, in the list of benign forecasts, is the chastened spirit to be observed at one end of Pennsylvania avenue.

A letter from a subscriber who is a car foreman on one of the large roads says the majority of passenger car repair shops are not up to the times for handling work. This was after a trip, taken something more than a year ago, in which the shops of a number of roads and manufacturing concerns were visited. No one will be inclined to dispute this assertion with regard to any but the newer shops, which doubtless constitute the minority that by inference our correspondent considers up-to-date. In this connection a glance at the latest practice, which is probably best exemplified in the Union Pacific car department at Omaha, now being rebuilt, will be of interest. Its arrangement and equipment were planned to minimize waste of time and labor, and to establish a system of routing work to avoid unnecessary handling and have a continuous forward movement. The department will have the sub-store feature to facilitate delivery of material. The coach shop has a 60-ton overhead traveling crane for removing and replacing trucks beneath cars. The wheel and truck shop has overhead traveling cranes for handling trucks and heavy material. There are electric trolleys and electric derrick cars for moving wheels and axles to and from the storage platforms and in the shops. A 10-ton electric crane spanning three tracks will be used for unloading wreckage and handling heavy material. The transfer table has the unusual length of 90 ft., which is 15 ft. greater than present general practice. The shop equipment will include the latest machinery to effect all possible saving in the cost of producing finished material and turning out work. As compared with the locomotive department, the car department problem is a simple one. Paramount considerations are: rapid and efficient distribution of material, and a continuous forward movement of the work. Yard cranes, telphers and overhead shop cranes are effective agents in the accomplishment of these objects, and have been employed in the Union Pacific plant more fully than in any previous instance. This does not, however, imply the neglect of industrial tracks for the movement of material. With these features well worked out, and suitable planing mill, forge shop and storage facilities, the rest is largely a matter of organization and methods.

The Great Central and the Great Northern are two English railroads which serve almost exactly the same territory and for the past 14 years have been strong competitors. They are now to be united under a working agreement which, according to the English custom of great publicity in such matters, is to be submitted to the shareholders of each company and after being there approved, to the Railway and Canal Commission. This consolidation—for apparently it amounts to nothing less—is brought about by the simple device of appointing the boards of directors of the two companies as a joint committee to manage the two properties. A working arrangement has been in force since the beginning of 1905 between the London & North Western and the Lancashire & Yorkshire which has resulted in greater efficiency and economy of operation to the railroads and better service to the public. Judging from similarity

of their territories, a like arrangement between the Great Central and the Great Northern should also be effective in producing these same results. Both roads run from London north to York, each with a network of branch lines reaching very much the same points, including Sheffield, Manchester, Liverpool, Leeds, Lincoln and the port of Grimsby on the east coast. There are in fact only four important towns on each system which the other does not reach either directly or by trackage rights. The Great Central has 1,072 miles of line and the Great Northern 1,257. The Great Central has gross earnings of $10,700,000 and net earnings of $3,600,000, against gross earnings of $14,800,000 and net earnings of $5,000,000 for the Great Northern. The history of the two companies is strikingly different. The Great Central was built about 1846 and was originally an east and west line running from Liverpool on the west coast across the country to Grimsby. The Great Northern was built from London north to Doncaster, which is on this cross-country line of the Great Central, in 1850. As long as the two lines were thus distinctive in their functions—one an east and west, the other a north and south railroad—they were close allies, but in 1891 the Great Central, under its then name of the Manchester, Sheffield & Lincolnshire, began to promote an extension to London, which was opened for passenger traffic in 1899. As a result of this move in 1893 the close alliance between the two companies was broken and the Great Central and the Great Northern became sharp competitors. The Great Central, however, under its old charter granted in 1858 when it was an east and west line only, was specifically authorized to unite with the Great Northern. Meanwhile the recent competition of the two roads resulted in duplication of facilities, particularly freight facilities, in a number of important towns. Recently, however, the Great Central has built a short line connecting with the Great Northern at a point not far north of London over which through trains are now being run between the southwest and the northeast of England. This evidence of co-operation has been followed by the announcement of the proposed consolidation of the two companies.

Statistics of the freight carried on the German railroads give striking evidence of the growth of productive industries in the Empire; a growth which has been surpassed probably only in this country. We discussed the growth of freight traffic in the United States in the *Railroad Gazette* of Sept. 27 last, when it appeared that the number of ton-miles increased from 173,221 millions in 1903 to 215,878 millions in 1906—24.6 per cent.—within three years. The German statistics give tons shipped and not ton-miles, which are sufficient as statistics of production, and in that country, where the average distance carried does not vary much from year to year, is sufficiently accurate as statistics of transportation. This increase in tons was from 315 millions in 1903 to 379 millions in 1906—64 millions, or 20 per cent., in the same three years. That this increase should be so near ours may seem surprising. It has not, however, been nearly so difficult for the railroads to handle as the growth here, for the reason that it has been much more regular. The increase here was less than 1 per cent. from 1903 to 1904; in Germany it was full 4 per cent. The next year freight traffic grew 7.4 per cent. here and 6 per cent. there; while from 1905 to 1906 we had to provide for an increase of 15.9 per cent.; the German railroads for one of 8.9 per cent. In the two years since 1904, the German railroads had an increase of 15.5 per cent., and ours an increase of 23.7 per cent., the growth here being greater in the later year than in Germany for the two years. Of course the absolute quantities carried are enormously greater in this country than in Germany, and if we go back to 1902, we find that the *increase* in four years in tons (not ton-miles) shipped by rail in the United States (431 millions) exceeded the *total* carried in Germany in 1906 (379 millions). This little problem, to provide in four years for a new freight traffic greater than that of the whole German Empire, is what our railroad managers have had to worry over. Doubtless they would have solved it much more satisfactorily if the growth had been at a somewhat regular rate, instead of 1 per cent. in one year and 16 per cent. in another. The average haul being longer here, a given amount of production causes an amount of transportation larger in proportion than in Germany. But compared with population, the number of tons shipped is astonishingly large here, where about 86 millions of people shipped 1,631 million tons of freight in 1906, which in Germany 60 millions shipped 379 million tons—19 tons per inhabitant here against 6.3 tons there. In both countries, the same ton is doubtless often counted twice. A through shipment over several connecting railroads is now counted but once here as well as there; but there is a large amount of freight which is shipped to a distributing point, there held in store, and later re-shipped to the consumer. A vast amount of grain in this country is so marketed. Iron ore shipped from the mines to the lakes, forwarded by lake, and then forwarded by rail to the blast furnace counts twice. Altogether it is probable that there is more of such traffic here than in Germany, and that we do not actually produce three times as much weight per individual as the Germans do. In both countries an enormous proportion of the whole tonnage is furnished by mines, furnaces and manufactures of metal—in Germany just about two-thirds of the whole tonnage.

MATTHIAS NACE FORNEY

Mr. Forney became attached to the *Railroad Gazette* during the first year of its existence as a serious newspaper. He had been for some time in the service of the Hinckley Locomotive Works, of Boston, but was then endeavoring to introduce an invention of his own, the "Forney locomotive," which had its chief career many years later on the elevated railroads of New York. The *Railroad Gazette* at the time was desperately in need of an editor with practical technical training; but, though the young man from the first made the impression of integrity, earnestness and highmindedness, no one guessed then that here was a man whose character outweighed the highest technical accomplishments. His career had been a struggle upward from modest beginnings. From his father's tanyard, after some schooling, he had gone into a Baltimore machine shop as an apprentice. He took drawing lessons, attended debating societies, read and studied, became an expert draftsman, and through this door entered the engineering profession. His tastes were as refined as if he had sprung from a long line of aristocrats. His senses were painfully acute, and his conscience was as acute as his senses.

During the first year of his connection with the *Railroad Gazette* Mr. Forney continued his professional work as consulting engineer, and thereafter gave the whole of his time to the paper. The great Chicago fire drove the *Railroad Gazette* to New York, which was the occasion of Mr. Forney's becoming one of its proprietors and directing its policy on the technical side for more than twelve years, until 1884, when he retired.

It is hard for railroad men of this day to appreciate what a task this was. There was then scarcely any literature on railroad mechanical engineering in America, and little other railroad literature. There were good engineers, and some of extraordinary ability, but few of them could write, and most of those who could write thought they couldn't; and moreover, there seemed to be a general feeling that a railroad man ought not to write for publication. The technical societies were unborn or in their swaddling clothes. Both the Master Mechanics' and the Master Car Builders' associations are younger than the *Railroad Gazette*. The technical editor to a very great extent was compelled to extract the results of experience and the opinions drawn therefrom by personal intercourse with the practical men; to obtain by pressure, as it were, the data which now comes in floods in the form of papers for technical societies and journals.

Mr. Forney will doubtless never get full credit for what he did to change this condition of things. His influence on the two societies named was very great, and otherwise he did much to favor the method of collecting data of experience, complete so far as possible, as a basis for conclusions and a guide for practice.

To us who knew Mr. Forney intimately, however, the character of the man overshadows all accomplishments and performances. He not only did justly, but he was willing to spend and be spent that justice might be done. He loved mercy, and he labored that the weak and helpless should be mercifully dealt with. In the later years of his life he gave a great deal of work and was at considerable expense to secure better treatment of horses—creatures with which personally he had little more to do than with elephants. Believing that material political progress is to be hoped for from minority representation, he published at his own expense a book on the subject, containing, with much else, the substance of other works then out of print. In many similar ways he demonstrated his public spirit, his humanity and his unselfishness. No one could more truly say:

"Write me as one who loves his fellow-men." S. W. D.

Forney was a dreamer and saw visions, but his dreams and visions were not unreal except as to time. For practical purposes he was apt to look too far in the future. His highly successful in-

vention of a tank locomotive was probably fully ten years in advance of the need for it, although he did not think so. Its chief value proved to be for suburban services, not then highly developed. He was among the early observers of the evil results of the foolish practice of high-checking horses and did much earnest work as a reformer, with the usual early disappointments. He sustained the same relation and like early disappointments in his advocacy of cumulative voting and minority representation. It was long years before he could get attention to his powerful and valid arguments, which resulted in the standardization of screw threads in this country, a reform whose beneficial results are incalculable. He was among the early engineers who recognized not only the value, but the absolute necessity of standardization in locomotive and car work. This was his central idea in joining in the reorganization of the Master Car Builders' Association on a basis which secured for it official recognition and caused the adopted standards to be generally accepted by the railroads in this country. His professional work is outlined in his own biographical notes, but little reference is made to his other activities, which were many. For example, his too long foresight is illustrated by his study, many years ago, of the real estate possibilities in a portion of the city of New York. To some extent he profited by this study in an important real estate investment. His undertaking to produce a commercially successful balanced engine occupied intervals of time through many years, but latterly his drawings and studies for a solution of the problem seemed to be a form of recreation. Nevertheless, he was always hopeful.

No one of Forney's friends will ever recall his personality without a quick thought of his peculiar sense of humor and his use of it. He was never a funny man and he abhorred such men. He had what might be defined a useful sense of humor and in the use of ridicule as an argument he was highly successful without being disagreeable. Whenever he spoke—and he spoke often at conventions of railroad associations and railroad clubs—he was always expected to be amusing as well as instructive, and he seemed never to disappoint either of these expectations, although it was plain that he was in thorough control of his power to amuse and he was using it for a specific purpose. In the use of ridicule for the purpose of argument in the discussion of mechanical problems he was masterful. For example, two locomotives designed by Eugene Fontaine were built at Paterson, N. J., and put at work. Before building these locomotives Mr. Fontaine naturally consulted Forney, then the highest authority, who gave him an adverse report on his design for superimposing the two forward driving wheels over the two rear driving wheels, so as to have a friction drive and be capable of adjustment for a high rate of speed with a slow piston motion and dispense with side rods. The machines were unsuccessful, but before this was discovered in practice Forney ended the discussion which the invention involved by an absurd drawing of a man driving a bicycle under somewhat like circumstances.

During the period 1870 to 1885 it was often said of Forney that he had a wider acquaintance and more friendships among railroad officers than anyone else, and this was perhaps true if we assume that friendship means respect. He was a man of many fads, none of them objectionable. He was well known for his condemnation of smoking. He maintained over his office desk a modestly printed card reading as follows: "Is smoking offensive? Yes, always," and yet frequently in his own office he would insist on a friend smoking when he noticed that the temporary abstinence was producing unrest.

Forney remained a bachelor until he was 72 years old and then married a friend of his youth, a lovable and helpful companion, and it is unquestionably true that his last year in this world was his happiest year.

W. H. B.

THE RECESSION OF A GOVERNOR.

Some six months ago, near the close of its long session, the Massachusetts legislature passed a bill, necessarily general in terms, but aimed actually at the New Haven-Boston & Maine merger. It was a veritable curio in railroad law-making, all the more grotesque as emanating from a commonwealth in which mind is inferred by tradition and habitude to dominate matter. It prohibited any railroad corporation of that state from acquiring or attempting to acquire, any shares of a Massachusetts railroad corporation; gave enlarged powers to the State Railroad Commission; and, until July of 1908, set the veto of the state on the voting power of stock held by a railroad company in another railroad company. The measure even went further and into the limbo of corporate psychology by prohibiting "any control, direction, supervision or influence whatsoever," directly or indirectly, by one railroad corporation over the other in which it had an interest. Apparently President Mellen was denied even telepathic communication with President Tuttle, and all train currents from the New Haven directorate flowing toward Boston & Maine territory were dammed up at the Massachusetts border. And this state embargo on influences concrete and mental was enforced by mighty penalties rising to $10,000 and a year's imprisonment for each offense.

All this was "before election" in Massachusetts. Politics were hot, personal ambitions vaulting high, candidates timid on the subject of popular sentiment, and Governor Guild, who signed the drastic measure afore-cited, himself seeking another term since obtained. It is "after election" now. There has been financial panic, contraction, industrial retreat. President Mellen has reduced train and trolley service, the looms of Massachusetts are humming much less than they did, and the verities of an industrial "drag," longer or shorter, rest upon the Bay state as upon other commonwealths of the land. In this sharp light of the luminous after event it is interesting to read the text of Governor Guild's message just sent in to the Massachusetts law-makers.

The Governor, last spring assertive, now becomes suggestive and interrogative. The public service corporations must still be made aware that the dignity and inviolability of Massachusetts statutes will be maintained. But "legislation that is merely destructive should be avoided. No policy which has not been thoroughly and carefully followed to its conclusion should be adopted. The burden of proof in any proposed change of management emphatically is on those seeking the change. He who asserts must prove. * * * Detailed and exact knowledge of actual existing conditions should precede any action in any case in question." Right here, by the way, one might criticize the Governor's own "exact knowledge" when later in his message he refers to one of the three steam railroad systems of Massachusetts as "dominated by an express company with headquarters in New York." Were not the American Express Company's holdings, direct and indirect, of about one-tenth of the outstanding Boston & Maine shares transferred some seven months ago to the New Haven by exchange of stock? The former one-tenth interest in the Boston & Maine has become an interest of about one-thirty-third in New Haven control now, and without a single New Haven director to represent it. Does it still "dominate" the Boston & Maine.

Mildly and in an interrogative form the Governor treats matters which a few months ago were expressed by the foes of the merger in Massachusetts as radical dogmatisms. He criticizes steam railroad service in the state and still favors the severance of railroads from the trolleys and from express corporations. But he holds it wise and beneficent that the railroad corporations should control steamship lines, this idea obviously carrying with it the wisdom of control of the Sound boat lines—a subject which has been "under investigation" at Washington and raised against the New Haven by some of its foes in Massachusetts. But it is upon the more relevant and imperative question, "Should one steam railroad be allowed to control another?" that the Governor's recession becomes most evident. He believes that "on certain terms permission for some union of interests not in violation of any national statute should be granted." This under larger powers of the railroad commission, with community of interest between the combined systems, under Massachusetts charters, with headquarters at Boston and the controlling system owning no Atlantic terminal for eastbound freight outside of New England. These conditions hit the New York Central. They obviously do not hit hard the New Haven-Boston & Maine merger proposition which has been the focal point of the recent acrimonious controversy.

After the bitter asperities of the Massachusetts anti-merger conflict, the recession of the Governor is suggestive even though one allows for the elimination of pre-election politics. In that state, as elsewhere, the pocket nerve of communities has begun to quiver and not without pain. Depressed industry and trade have struck home and, as usual in manufacturing regions, struck home quickly. The large ratio of the railroad in the sum total of commercial welfare and touching that welfare not merely as a carrier and as an employer of labor, but through the fiscal weal of thousands of shareholders, becomes more luminous in the gloom of industrial depression. Corporation backing recedes when the public finds that it is baited too. Governor Guild is but one of many advance agents to proclaim these economic truisms, nor does judgment go far astray when it infers that the Massachusetts legislature will be but one of a good many lawmaking bodies to follow his example.

Atlantic Coast Line.

The Atlantic Coast Line-Louisville & Nashville system is the largest, richest and most important of the three large railroad systems in the South. The Atlantic Coast Line itself without the Louisville & Nashville is stronger than either the Seaboard Air Line or the Southern Railway. As its name implies, its territory is the strip of country south of Chesapeake bay nearest the Atlantic coast. This coast strip, as the map shows, it occupies very completely. Generally speaking, the Seaboard Air Line occupies the north and south strip next inland; and the Southern Railway, the territory further inland still.

The Richmond & Petersburg, a 25-mile road chartered by act of the legislature of Virginia in 1836 and opened for traffic between Richmond and Petersburg on September 17, 1838, was the beginning and nucleus of the Atlantic Coast Line. Various other railroads reaching southward along the coast as far as Charleston, S. C., and inland from the coast, were bought by the owners of the Richmond & Petersburg and were operated together as "The Atlantic Coast Line of Railways to the South." Control of these allied roads was transferred in 1889 to the Atlantic Coast Line Company which was organized in that year under the laws of Connecticut. In 1900, by amendment of the original Virginia legislative act, the name of the Richmond & Petersburg was changed to the Atlantic Coast Line Railroad. With this were merged a few months later the other railroads controlled by the Atlantic Coast Line Company. The fact that the Atlantic Coast Line Railroad is the successor of the Richmond & Petersburg explains the fact that its report for the year ended June 30, 1907, is the "seventy-third annual report."

In 1901 the Savannah, Florida & Western, the principal railroad of the Plant system, was taken over, and in the following year the rest of the Plant system of railroads. Previous to these acquisitions the Atlantic Coast Line had operated about 1,800 miles of line, all, with the exception of a line from Columbia to Port Royal, north of Charleston, S. C. The acquisition of the Plant system added about 2,200 miles south of Charleston, including a main line through Savannah, Ga., to Jacksonville, Fla., a branch eastward from this main line to Montgomery, Ala., and a large mileage of branches and connecting lines in southeastern Georgia and in Florida. These additions brought up the Atlantic Coast Line mileage to over 4,000 miles.

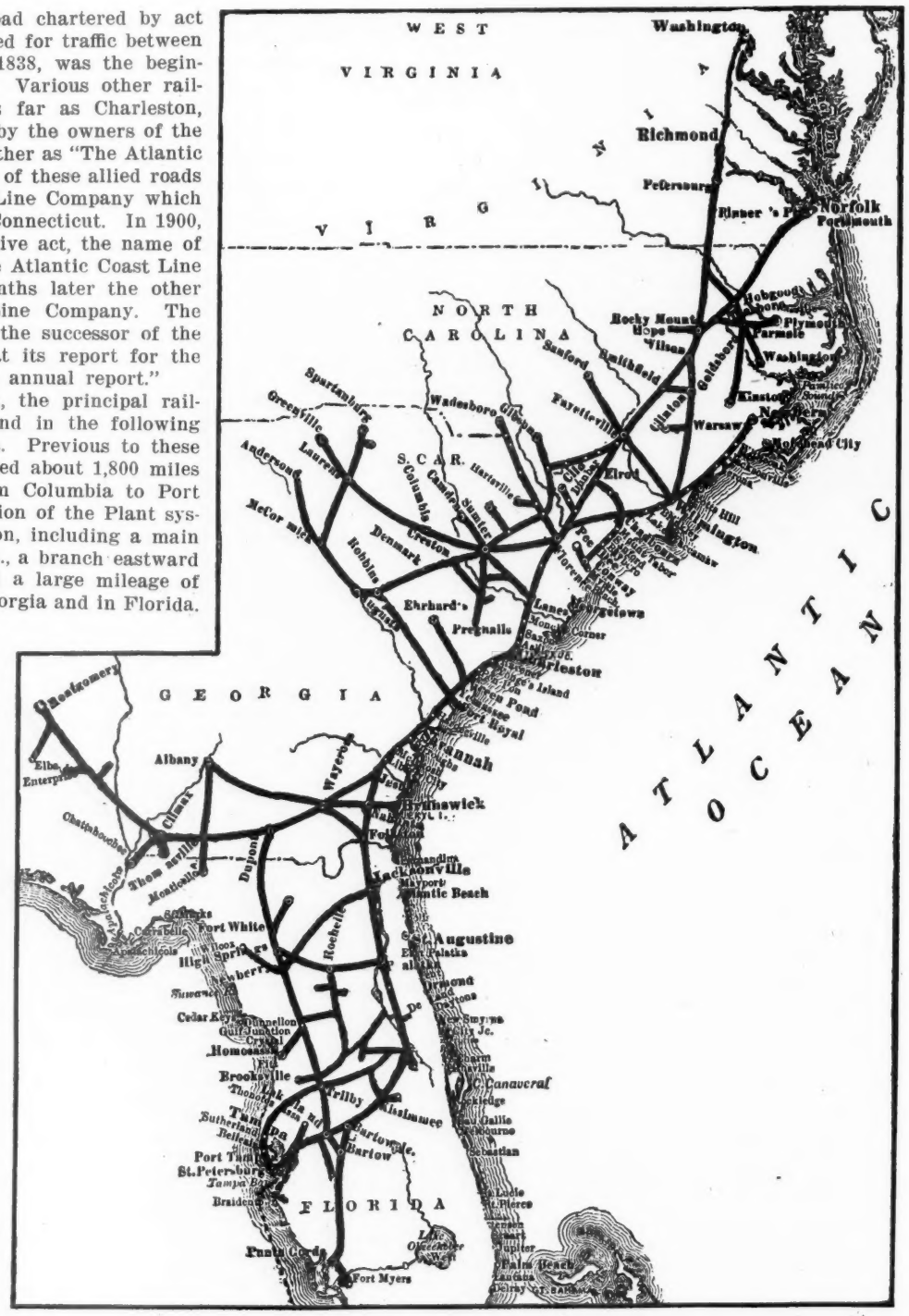
In October, 1902, as a result of the sale by the Louisville & Nashville of new stock previous to its issue and listing on the New York Stock Exchange and the Gates corner which followed, it was arranged that the Atlantic Coast Line should buy a majority of the stock of the Louisville & Nashville. Control of this road has since been held, but the two companies are operated separately. Ownership of the Louisville & Nashville, which lies to the westward of both the Seaboard Air Line and the Southern, has been valuable among other reasons because the Atlantic Coast Line has received from it, either directly or through controlled roads, considerable high grade and other traffic.

With the taking over of the Plant system and the Louisville & Nashville purchase, the power and importance of the Atlantic Coast Line Company were greatly increased, so that now, according to the annual report of the Interstate Commerce Commission issued last week, this holding company, with a capitalization which probably represents not more than $5,000,000 of actual investment, is in virtual control of a railroad system more than 11,000 miles long.

For many years the Atlantic Coast Line was the aristocrat of the southern railroads. It had money to spend and it bought the best. As recently as 1906 its stock sold as high as 167. But it could not escape the consequences of the various adverse factors which have developed in the South during the last two years. Along with its poorer neighbors, it suffered severely. Net earnings for the last fiscal year were the smallest earned in any year since the Plant system was taken over. The net earnings in 1903 were $7,800,000, while last year's net amounted to only $7,200,000; all this while gross earnings were increasing, so that from $19,700,000 in 1903 they rose to $26,800,000 last year. In four years, therefore, there was an increase of 36 per cent. in gross earnings and a decrease of 8 per cent. in net earnings. Even with its better equipment, larger yards and terminals and greater *esprit de corps*, the Atlantic Coast Line was not able to handle the sudden rush of traffic in the South. In a speech on March 7, 1907, at the annual banquet of the Wilmington Chamber of Commerce, President Emerson showed that for the 19 months from June, 1905, to February, 1907, "prosperity" brought in nearly $4,000,000 additional revenue, but the same "prosperity" took away in the way of increased wages, increased cost of material, etc., nearly $5,000,000, so that for this period the Atlantic Coast Line's share in the prosperity of the South was represented by about $900,000 less than nothing.

Meanwhile the public was demanding increased facilities, more and better equipment, improved stations and more of them, and faster freight movement. Mr. Emerson showed that in order to meet these demands the Atlantic Coast Line during the 3½ years preceding March 1, 1907, had bought new equipment costing $15,800,000, and had spent for yards, terminals, new stations, heavier rail, signal towers and interlocking plants, double tracking, etc., $6,200,000, which latter amount did not include $2,000,000 more authorized but not then spent owing to scarcity of material and efficient labor. On July 1, 1902, the road owned 13,157 freight cars. On January 1, 1908, if delivery of new cars ordered was made promptly, it owned about 26,000 freight cars, or nearly 100 per cent. increase in 5½ years. These large expenditures, too, were made at a time when prices were high. For instance, box cars which in 1904 would have cost from $500 to $550, in 1907 cost $900 to $1,000.

Early in the year these expenditures for new improvements came to a sudden stop. In February the Atlantic Coast Line sold $5,000,000 5 per cent. 3-year gold notes at 95½ net, but since then it has been able to get no new funds. Its working capital, in fact,



Atlantic Coast Line.

fell so low that the semi-annual dividend of 3 per cent., declared in December, was made payable in 4 per cent. certificates of indebtedness instead of in cash. On Wednesday the closing market price for Atlantic Coast Line stock was 72.

President Emerson speaks as follows in regard to the rate reductions of the year. His brief comment should be pondered by every citizen who favors reductions of railroad rates by act of legislature without investigation:

"Since our last report the following named states, either through their legislatures or corporation commissions, have taken such action as will greatly reduce your passenger rates:

Virginia.

By corporation commission: Reducing passenger rates from 3 cents a mile to 2 cents a mile, effective Oct. 1, 1907.

North Carolina.

By act of legislature: Reducing passenger rates from 3¼ cents a mile for first-class, and 2¾ cents a mile for second-class, to 2¼ cents a mile for both classes; effective Aug. 8, 1907.

Georgia.

By railroad commission: Reducing passenger rates from 3 cents a mile to 2¼ cents a mile, effective Sept. 1, 1907.

Alabama.

By act of legislature: Reducing passenger rates from 3 cents a mile to 2½ cents a mile, and also a material reduction in freight rates, effective Oct. 1, 1907.

"We are now operating these reduced rates, although we believe them to be confiscatory, and their legality is being tested in the courts; in the meantime the company is suffering irreparable loss pending final decision."

Gross earnings for the year increased $1,900,000, or 8 per cent. over 1906. Freight earnings increased 6 per cent. and passenger earnings 12 per cent. Operating expenses were larger by $3,500,000, or 22 per cent. As a result there was a decrease of $1,600,000, or 18 per cent. in net earnings. Net income was $3,100,000, against $4,800,000 in 1906, a decrease of 40 per cent. The operating ratio was 73.2 per cent., against 64.7 per cent. in 1906. After payment of the regular dividends, there was a surplus for the year of $126,000, against $2,100,000 in 1906, a decrease of 94 per cent.

The income results of particular interest are in the operating expenses. Maintenance of way and structures (not including $249,000 charged in this account for additions and betterments) increased 18 per cent. and cost $842 per mile of line, against $719 in 1906. Large improvements were made to the roadbed. There were 352 miles of new 85-lb. rails and over 2,000,000 new cross ties laid in track. Nearly 14,000,000 board feet of lumber, not including piling, were used in new work and repairs. Work was begun in February on 22 miles of new second track in North Carolina. With completion of this, the road will have 86 miles of second track on its 4,347 miles operated. There were many general improvements, including new bridges, changes of line, new freight yards at South Rocky Mount, and Wilmington, N. C., and at Southover Junction, near Savannah, Ga.; new freight and shop yards and new shops at Waycross, Ga., and coal storage plants of 40,000 tons capacity, at South Rocky Mount and at Waycross. All these were to have been finished by the beginning of 1908.

Maintenance of equipment (not including $9,000 charged for additions and betterments) increased 28 per cent. Repairs and renewals of locomotives cost $2,108, against $1,948 in 1906. The 1907 figure included $94,000 charged to replace missing numbers. Repairs and renewals of passenger cars cost $838 per passenger car, against $754 in 1906. The 1907 figure included $41,000 charged to replace missing numbers. Repairs and renewals of freight cars cost $78 per car, against $73 in 1906. This item for 1907 included $258,000 charged to replace missing numbers. New equipment costing over $5,000,000 was contracted for on equipment trusts for delivery between March and November, 1907. The apportioning between capital and operating accounts of the expenditures for new equipment, are given clearly and fully, an example which ought to be followed by all railroads.

Conducting transportation, the cost of getting and moving the traffic, increased from $9,000,000 to $11,000,000, a rise of 23 per cent. Part of this was due to the greater traffic, for there was an increase of 11 per cent. in revenue ton-miles and of 12 per cent. in revenue passenger-miles. Engine miles (coal burning)—perhaps the most accurate test of the amount of work done—increased 16 per cent. Mr. Emerson analyzes certain increases in expenses aggregating $2,700,000, or 78 per cent. of the total rise in operating expenses. Most, though not all, of these fall under the head of conducting transportation. The analysis of these increases follows:

	Increase.
Changes in method of accounting	$44,089
Replacement charges, equipment and structures	124,871
Materials and supplies	615,561
Overtime	84,189
Paid foreign roads for car repairs	69,957
Fuel, increased consumption	248,985
Car mileage balance	266,899
Loss and damage	221,371
Roadway pay roll	245,461
Shop force pay roll	272,389
Other additional forces	76,702
Pay roll of train crews	163,877
Other pay rolls	296,888
Total	$2,731,239

With this may be compared another table published in the annual report for 1906 analyzing certain increases in expenses for the last six months of that fiscal year, which amounted to $1,845,876, or 70 per cent. of the increases in operating expenses for the whole fiscal year ended June 30, 1906. This table follows:

	Increase.
Additions and betterments	$227,975
Real estate purchased	6,553
Changes in method of accounting	26,375
Additions to force	454,435
Wages	41,700
Various small items	42,276
Replacement charges, equipment and structures	225,918
Material and supplies	158,029
Overtime	65,503
Paid foreign roads for car repairs	44,044
Fuel, increased cost per ton	85,602
Fuel, increased consumption	160,976
Car mileage balance	144,287
Loss and damage	159,814
Rentals	2,389
Totals	$1,845,876

These statements suggest the difficulties with which the management has had to contend in the last two years.

No classification of tonnage by commodities is given in the report. The Atlantic Coast Line's traffic is quite different from that of any other road. Probably the two most important items are fruit and vegetables, and lumber—two widely different classes of traffic. The perishable fast freight traffic of the road is large and varied. From its southern lines it carries Florida oranges, lemons and grapefruit to the northern markets; Georgia sends peaches; South Carolina and North Carolina, small fruits and vegetables. The Atlantic Coast Line has been known to haul in one day off its main line between Florence, S. C., and Weldon, N. C., 210 miles, as many as 700 cars of strawberries. Last year there was a shortage of the strawberry and vegetable crops which resulted in a decrease of $239,000 in gross earnings from these sources, but other traffic more than made up for this loss. The extent of the refrigerator traffic is reflected in the trainload, which is 179 tons. The next two most important items of traffic are probably naval stores and phosphate. The road has an agricultural and immigration department through whose efforts 578 heads of families, in addition to a large number of settlers placed by other agencies, last year located on the lines to engage in agriculture. There were 127 new industries started.

Since November the traffic of the road has shown a great falling off. The lumber industry was one of the first to be hard hit by the panic owing to the general suspension of building and construction operations. There has also been a large decrease in general traffic. These are the most unfavorable features of the present situation. On the other hand, public opinion is changing. The people of the South are beginning to realize that railroad officers were sincere when they prophesied that the legislative attacks on the railroads would hurt the people of the South. The receivership of the Seaboard Air Line has had some effect in bringing about this change, but even before that happened, the effects of the industrial depression were being sharply felt in the South and it was obvious that the attacks on the railroads had been one of its principal causes. The future of the Atlantic Coast Line rests largely with the people of its territory. The officers of the road are doing their best, as they have been, to be fair in their treatment of the public. They ask in return justice; no special favors, but an understanding by the public of the facts and difficulties of railroad operation; and the passage of laws based in fairness on these facts. The most encouraging sign of the present railroad situation in the South, amid all its discouraging features, is the tendency toward a fair and reasonable co-operation between the railroads and the public.

The following table, rearranged according to our usual method, shows the income results of the Atlantic Coast Line Railroad for the past two years ended June 30:

	1907.	1906.
Mileage worked	4,347	4,327
Passenger earnings	$6,083,991	$5,436,173
Freight earnings	18,443,695	17,374,526
Gross earnings	26,771,529	24,868,448
Maint. way and structures	3,660,312	3,112,368
Maint. of equipment	3,936,686	3,071,036
Conducting transportation	10,988,157	8,904,691
Operating expenses	19,328,625	15,746,097
Net earnings	7,442,904	9,122,351
Net income	3,376,708	5,153,175
Dividends	2,992,086	2,718,630
Improvement appropriations	258,753	336,233
Year's surplus	125,869	2,098,312

NEW PUBLICATIONS.

How to Burn Illinois Coal Without Smoke.—Bulletin No. 15 of the Engineering Experiment Station of the University of Illinois, on the above subject, by L. P. Breckenridge, Director of the Station, has been issued. A few pages are devoted to the principles of combustion and the losses due to smoking chimneys, but the larger part of the bulletin relates to the constructive features of those boiler settings and furnaces that have been found practically smokeless in operation at the power plant and in the experiment station at the University of Illinois. The leading dimensions of the settings and furnaces are given, and sectioned cuts show the general character of the settings. With each cut is given a state-

ment as to the range of capacity of each setting for smokeless operation. Especial emphasis is given to the importance of knowing the rate at which the coal is to be burned on each square foot of grate surface, together with the percentage of volatile combustible which the coal contains, and for which a suitable combustion space or chamber must be provided. Some interesting illustrations show clearly the significance of the numbers used in describing smoke densities, and there is also a chart devised for making graphic records of smoke observations. Five tables of tests are given showing the conditions of operation of a smokeless furnace under changes of boiler capacity varying from 50 to 150 per cent. There are no illustrations showing approved settings for the horizontal fire-tube boiler, but suggestions are given as to methods of hand firing which will tend to reduce smoke production.

While this bulletin discusses the smokeless burning of Illinois coals, the principles and methods explained apply equally well to the burning of all kinds of soft coal. Copies of this bulletin may be had free by writing to the Director, Engineering Experiment Station, Urbana, Ill.

Tests of Reinforced Concrete Beams.—Bulletin No. 14, Tests of Reinforced Concrete Beams, Series of 1906, has been issued by the University of Illinois Engineering Experiment Station. The tests described are a continuation of the tests discussed in Bulletin No. 4. The topics investigated include the effect of quality of concrete upon the strength of beams, the effect of repetitive loading upon the action of beams, and the resistance of beams to diagonal tension failures. The results of the investigation of diagonal tension failures throw light upon the amount of the vertical shearing stress which may be allowed in reinforced concrete beams not having metallic web reinforcement. The resistance of beams to diagonal tension may be the controlling feature of relatively short beams, and as such failures occur suddenly and without much warning, a knowledge of the resistance of the concrete is essential. Some beams gave surprisingly low values and it seems evident that the values allowed by many city building ordinances are higher than should be recommended. The tests of plain and reinforced concrete columns and of reinforced concrete T-beams for 1906 have already been published.

Manual of Recommended Practice of Railway Engineering and Maintenance of Way. 1907 edition. Published by the American Railway Engineering and Maintenance of Way Association, Chicago. Cloth, 291 pages; 6 in. x 9 in. Price, $3.

The first edition of the Manual was published in 1905 and covered the work of the first six conventions of the Association. Last year a supplement was published containing the amendments and addenda to the Manual adopted by the Association at its 1906 convention. This bore the title, "Supplement of 1906, Addenda to Edition of 1905," and was contained in Bulletin 79 of the Association. The present edition contains all matter in its final and duly authorized form as adopted by all conventions to 1907 inclusive. The volume has almost twice the number of pages of the first edition. The style of printing and the arrangement is similar to that of the annual Proceedings, the marginal topic headings being a great help to quick finding of any point sought. The Manual of this Association has been in demand by railroads in all parts of the world, and its value and usefulness increase each year.

CONTRIBUTIONS

The Service of the Railroads.

Albany, N. Y., Jan. 9, 1908.

To the Editor of the Railroad Gazette:

In the *North American Review* of November, 1907, Logan G. McPherson brings out some interesting comparisons under the heading, "The Farmer, the Manufacturer and the Railroad." Mr. McPherson's figures are taken from the reports of the Interstate Commerce Commission, the United States census and the Year-Book of the Department of Agriculture, and show:

	1905.	1900.
Gross returns per $1,000 of capital:		
Manufacturers	$1,216	$1,324
Railroads	150	128
Agriculture	191	187
Net returns per each $1,000 of capital:		
Manufacturers	151	194
Railroads	44	41
Agriculture	98	92
Average salary—wage per worker:		
Manufacturers	539	477
Railroads	607	567
Total salary—wage per each $1,000 of expenditure:		
Manufacturers	245	245
Railroads	572	568
Total salary—wage per each $1,000 net returns:		
Manufacturers	1,730	1,430
Railroads	1,362	1,223

These figures bring out clearly the following points:

1. That the gross returns or receipts per dollar of investment in the railroads of the United States are less than the receipts either from manufacturing or from money invested in agriculture.

2. That the interest, reward or profit on each dollar invested in the railroads is 4.4 per cent., while that of the money invested in agriculture is 9.8 per cent., and in manufacturing 15.1 per cent.

3. That the average salary paid by the railroads of the country is 12.6 per cent. greater than the average paid by the manufactures, and, if the figures were known, is wonderfully greater than the average pay of those engaged in agriculture.

Mr. McPherson also states: "The outcry has been taken up by politicians—who do not ship freight or pay freight bills—and their utterances have impressed the great body of the people, who likewise do not to any appreciable extent ship freight or directly pay freight bills. These people have been ignorant of the fact that the freight charges have been in constantly decreasing ratio to the cost of production and the cost of marketing the great commodities of daily need. The freight charge is so low that it is seldom a factor in the retail prices of these commodities. That is, the retail prices of the commodities of daily use, with but few exceptions, are determined without reference to the rate of freight; they would be neither higher nor lower if the commodities were transported by the railroads gratis."

That the American railroad has done this much and even more for the United States is in a measure brought out by the following statements.

The developing of the manufacturer and of the agriculture of the country can be said almost to depend upon its transportation—its railroad building, which has pushed forward to such a point that in 1905 there was one mile of railroad for each 381 people.

Year.	Population U. S. census.	Miles of railroad.	Population to each mile of railroad.
1820	9,633,822	..	9,633,822
1830	12,866,822	23	559,392
1840	17,069,453	2,818	6,057
1850	23,191,876	9,021	2,571
1860	31,443,321	30,626	1,026
1870	38,558,371	52,922	728
1880	50,155,783	93,262	537
1890	62,622,250	166,703	375
1900	76,303,387	194,262	392
1905	83,143,000	218,101	381

Thoroughly to appreciate what this enormous growth of railroad mileage means, it should be compared with the railroad mileage in some of the principal countries of the world.

Country.	Miles of railroad.	People to each mile of railroad.	Square miles to one mile of railroad.
France	24,500	1,590	8.46
Brazil	12,370	1,558	260.16
Austria Hungary	26,901	1,789	9.70
Belgium	4,337	1,631	2.62
China	3,500	119,714	1,443.00
German Empire	33,423	1,813	6.25
Italy	9,943	3,286	11.12
Japan	4,496	9,844	36.17
Russian Empire	38,045	3,548	220.24
Spain	8,206	2,267	23.90
United Kingdom	22,847	1,821	5.29
United States	218,101	381	13.61

Regardless of the fact that these statements show that there is almost five times as much railroad mileage per capita, or, in other words, only one-fifth the number of people to support each mile of railroad—the charges for transportation of freight in this country are lower than in any country probably in the world.

That the charge for passenger transportation is wonderfully low, considering the fact that there is only one-fifth the population per mile, is shown by the following figures obtained from the Department of Commerce and Labor, Bureau of Statistics, and from the British Statistical Abstract of Foreign Countries, published by the Board of Trade, London; from the Interstate Commerce Commission and the London *Statist*:

Freight. Country.	Year.	Rate per ton per mile in Cents.
United States	1905	0.766
Germany	1904	1.352
France	1904	1.428
Austria	1904	1.503
Russia, European	1903	1.018
Russia, Asiatic	1903	1.157
England (United Kingdom)	1903	2.160

Passenger. Country.	Year.	Rate per passenger per mile in cents.
United States	1905	1.962
Germany	1904	0.992
France	1904	1.133
Russia, European	1903	0.722
Russia, Asiatic	1903	0.458

But it is said that the American railroad is overcapitalized, regardless of the fact that the income earned on a dollar invested in American railroads is less than that of a dollar invested in almost any other line; that the average wage paid by the railroad is greater than that paid in almost any other form of business; that their charge for freight transportation is less than in any other nation in the world; and that their passenger charge, when considering the character of the equipment, the speed of the trains, the excellence of the service and the limited number of people to be transported compared with those of other countries, is wonderfully low. The ground is not well taken, as clearly shown by the following figures which are copied from a report on the transporta-

tion routes and systems of the world, issued by the Bureau of Statistics of the Department of Commerce and Labor.

Country.	Year.	Capital or cost per mile of railroad.
United States	1904	$55,261
Canada	1904	60,504
Uruguay	1899	52,758
Venezuela	1904	70,972
Germany	1903	98,443
Austria	1903	128,334
Hungary	1903	74,056
Belgium (State railroads only)	1903	160,893
France	1902	137,601
Switzerland	1903	104,969
United Kingdom	1904	272,737
Russia	1902	78,553
Finland	1902	32,189
Norway	1904	38,371
Sweden (State railroads)	1904	44,669
Sweden (private railroads)	1902	22,006
Italy	1902	108,212

As a matter of fact, the capitalization of the American railroad is vastly less than the actual value of the properties to-day. It is very much to be doubted whether one railroad in 20 could be replaced for its existing capitalization. The roads have forged ahead so rapidly that seldom, if ever, could their bonds be sold for par; in some cases they were sold at a discount as great as 40 per cent., and in many cases, in addition to a discount on the bonds, stock bonuses had to be given. This was necessary in order that the country could have this vast railroad growth and that the country could be built up to its present greatness.

Each year vast sums out of earnings are put into bettering the properties, in the form of heavier bridges and rail, better stations and grade and line changes; and these sums have not been capitalized and are of such magnitude that they would equal dividends of from 2 to 3 per cent. yearly on the entire stock capitalization. Again, the land and property increment in value is not capitalized and it is increasing at a rate of 4 or 5 per cent. a year, and in the case of railroad terminal property has reached vast proportions. An illustration: one of the important trunk lines paid a few hundred dollars for its terminal when entering the city of Chicago. Recently, under oath, a number of railroad presidents testified that the value of this property was from 12 to 15 million dollars.

As pointed out by Mr. McPherson, the people of the United States do not realize what has been done for the country by its railroads, or the present hostile conditions would not exist. Apparently every one of the 46 states in the United States is passing hostile railroad legislation. Some of it is confiscatory in its results. Much of it is unnecessary, ill-advised and harmful, and a little of it is proper and will have a healthful effect. All of it, however, has had the effect of undermining the credit of the railroads, and already one great line has gone into the hands of a receiver; and the monthly returns of the railroads unfortunate enough to be located in the states where legislation has been most drastic show that they are being sadly hampered; that their earnings are being depleted; that for lack of money, necessary railroad work is being stopped or slowed up all over the country; that they have had to borrow money on short-time notes at high rates of interest; and that the additional moneys which unreasonable legislation has deprived their making would have been put to very much better advantage were it used in the building of additional second-track, of block signaling and bettering the physical conditions of the properties.

Over 90 per cent. of the American railroad system is still single track, while in the United Kingdom there is only a little over 40 per cent. of single track. The further growth of the American manufacturer and of the agricultural interests of the country depends absolutely upon the prosperity of the American railroad.

That, in some few cases, there has been rebating and undue favoritism, is admitted, but the enforcement of the Elkins law absolutely stopped these practices. It is most unfortunate that through lack of exact information the American public should have any other than the kindest feeling toward its transportation properties; and as the people of this country have righted every wrong just as quickly as it is demonstrated, so will they correct the present situation when its vast importance and the injustice done is clearly brought to their attention.

C. S. SIMS,
Second Vice-Pres. and Gen. Mgr. Delaware & Hudson Co.

Analogy of Conditions in 1884 and in 1907.

New York, Jan. 13, 1908.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your editorial entitled Five Panics (Dec. 27, 1907) says that the 1907 panic was more akin to that of 1884, in many important respects, than it was to any other of our serious commercial setbacks in this country, and because of this you conclude that the after-drag is going to be short and the recovery comparatively rapid. The Annual Review of the Foreign Commerce of the United States, recently published by the Department of Commerce and Labor, puts in evidence a rather striking confirmation of one phase of the resemblance between 1884 and 1907—the trade balance. The following table (specie not included) illustrates this point:

	Excess			Excess	
	Of imports.	Of exports.		Of imports.	Of exports.
1837	$19,029,676	.....	1884	.....	$72,815,916
1857	54,604,582	.....	1893	$18,735,728	.....
1873	119,656,288	.....	1907	.....	446,429,653

I realize that this showing was affected by local conditions in each of the above years, and that it is to a certain extent superficial. Nevertheless it certainly indicates an interesting tendency which bears out your analysis—and we should all like to believe that your prophecy of a short drag is correct.

HISTORIAN.

The London Underground Troubles.

The Lot's Road, Chelsea, power house which is furnishing electrical energy to the district, several tube lines, and to a portion of the system of the London United Tramways, is supplying an average output of about 100,000,000 units per annum, which are sold at a price which while reasonable from the point of view of the different interests mentioned, is also yielding a satisfactory profit on the power house expenditure. In mentioning this fact in the annual report recently issued, the directors of the Underground Electric Railways Company of London show how far their different tube lines have been advanced structurally during the year, and they add some notes concerning the progress that each has been making from the traffic standpoint. The following references are made to the appointment of Mr. Stanley and to the troubles of financial and competitive kinds that the concern has been and is still passing through:

In April of this year the directors secured the services of Mr. Albert H. Stanley, who was up to that time general manager of the New Jersey Public Service Corporation. He is now the general manager of the Underground Electric Railways Company, as well as of the District and the three tube companies above mentioned, by which means co-ordination and uniformity of operation are secured. The very unsettled state of the money markets of the world has seriously hampered the development and operations of the company, and this unrest still continues. Stocks all over the world have depreciated in price, and those dependent on London traffic have, owing to severe competition and excessive reduction in fares, fallen lower than many securities of intrinsically less value. The competitors for London passenger traffic include the London County Council, on whose growing network of tramways passengers are carried at fares which it is believed are in many cases unremunerative, and the motor omnibus companies, who have come into the field since the incorporation of the company, but who can probably not operate profitably on the basis of their existing fares. It seems at last, however, to have been universally recognized that for a large number of companies to carry passengers at a loss is not sound business. The responsible heads of the principal London passenger traffic companies have, therefore, recently constituted a Traffic Conference under the chairmanship of the company's managing director, Sir George Gibb, for the purpose of discussing the best means by which injurious competition can be, as far as possible, avoided. The Board has been for some time considering (in conjunction with Messrs. Speyer) a plan for dealing with the £7,000,000 notes which will become due on June 1, 1908. It is hoped that within a short time, probably early in 1908, the plan will be published and submitted to the shareholders and noteholders for their approval. In the meantime, Messrs. Speyer offered to purchase at their face value the coupons on the notes due December 1, 1907.

Immigration in 1907.

The total number of cabin and steerage passengers landed at the port of New York during 1907 by all the transatlantic steamship lines was 1,287,617. In 1906, the number was 1,159,551; in 1905, 992,065. The largest number of passengers was carried on the ships of the North German Lloyd Line from Bremen and from Mediterranean ports. In 151 trips, 222,121 passengers were landed by the steamers of this line, and of these 17,051 were first cabin voyagers. The Hamburg-American Line, with 131 steamers arriving, brought 200,909 passengers, of which number 16,991 were first cabin. The White Star Line, from Liverpool, Southampton and the Mediterranean, landed 16,748 first cabin passengers, and the total number brought by this line was 115,859. The trips numbered 98.

The Cunard steamers, from Liverpool and the Mediterranean, brought 147,766 passengers of all classes, and of these 12,086 were first cabin. Sailings to the number of 100 were made. The Red Star Line, from Antwerp, brought 81,642; the French Line, from Havre, 83,882, and the Holland-American Line, from Rotterdam, brought 62,056 passengers of all classes. Composed of four lines and six services the International Mercantile Marine Company's ships made 196 trips from foreign ports, and brought a grand total of 237,906 passengers of all classes.

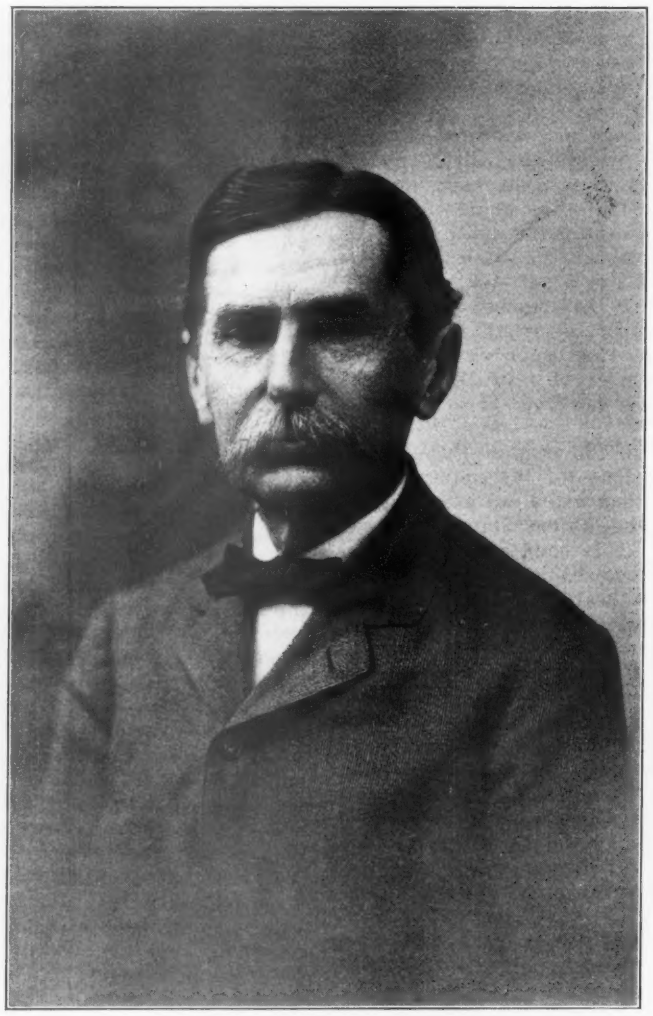
Autobiographical Notes by Matthias Nace Forney.

News of the death of Mr. Forney after a first attack of paralysis, Jan. 14, came as an entire surprise to almost all his friends. We are glad to have the opportunity to print the following notes, which he gathered together in 1903:

If tradition and the record of the family Bible can be relied on, I was born in the old house on Chestnut street, in Hanover, York County, Pennsylvania, on March 28, 1835. My father, after whom I was named, died on March 25, 1837, leaving our good mother, Amanda Forney, to take care of three sons and three daughters.

The school education which was administered to us in Hanover in those early days was of a somewhat irregular kind, and depended upon the ministrations of teachers of a more or less itinerate habit. They were good, bad and indifferent—chiefly the latter—so that our book knowledge had to be assimilated from much indigestible food.

Very early in life mechanism and science interested me very much. It gave me great pleasure to decorate the top of our old woodshed with miniature windmills, to construct water-wheels which were driven by the stream from a spring near the house, and to make toy cannons out of anything which would hold a charge of powder. My great ambition was to build a small steam-engine, but for that my mechanical resources were not adequate, although I made a number of attempts in that direction. Tools and machinery were my delight then, and have been ever since. I then always had a workshop which was very poorly equipped with carpenters tools, but it was a source of endless pleasure to me. My first ambition was to be a shipbuilder, then steam-engines took hold of my imagination and finally locomotives got possession of me and have absorbed much of my time and thoughts ever since.



Matthias Nace Forney.

When fourteen years of age I was sent to a school in Baltimore, with my brother George, who had already been there two years before me, where he had attended the "Collegiate Department of the University of Maryland," under which high sounding title Mr. Horace Morison—an uncle of the engineer, the late George S. Morison—conducted a school of from thirty to forty boys. Three winters were spent there, which ended my school education.

In April, 1852, I entered the shop of Ross Winans as an apprentice. He was then engaged in building locomotives in Baltimore, chiefly for the Baltimore & Ohio Railroad. Three years were spent in the shop, and after that one was spent in the drawing office. I then secured a position as draftsman in the shops of the Baltimore & Ohio Railroad, in Baltimore, then under the charge of Mr. Henry Tyson, who was Master of Machinery of the road, and continued in that position altogether about three years. As the prospect of advancement there seemed very poor, in 1857 or 1858 I was led to go into mercantile business in Baltimore, and continued in such occupation for about three years more. This brought me to 1861, the period of the outbreak of the War of Secession.

My business ventures up to this time had not been successful. All business in Baltimore was much disturbed, and after trying a number of different occupations I accepted a position as draftsman in the Machinery Department of the Illinois Central Railroad in Chicago, then under the charge of Mr. Samuel J. Hayes, who was Superintendent of Machinery of that road.

While employed there I designed an "improved tank locomotive," which afterwards became known as the "Forney engine." A patent was applied for, but there was considerable difficulty and delay in the Patent Office before the patent was allowed, so that it was not issued until 1866. Although every effort was made to introduce it into use, my efforts had little success until it was adopted for the New York Elevated Railroads nearly ten years after the patent was allowed. No other kind of locomotive was ever used on those roads thereafter, and it was also exclusively adopted in the Brooklyn and Chicago Elevated lines, and many were also built for other roads. Now, 1903, these engines have been superseded in the elevated roads by electric power, but it is still a popular form of locomotive for suburban and some other kinds of traffic. After the patent expired it was very generally adopted. It was a source of some profit to me during the latter part of the existence of the patent, but never paid as much as it would if the merits of the invention had been recognized earlier.

My engagement on the Illinois Central Railroad also continued for about three years. After this a brief engagement as draftsman with the Detroit Bridge & Iron Works followed, which was succeeded in the spring of 1865 by an appointment by the President of the Illinois Central Railroad Company, to superintend the building of some locomotives for that line, for the construction of which a contract had been made with the Hinckley & Williams Works in Boston. This was in the spring of 1865, and occupied me for about six months. When the engines were completed Mr. Williams made an arrangement with me to remain in their employ. My duties were partly those of a draftsman and partly of a traveling agent. My services there also lasted about three years.

During the last year of that term, my office and headquarters were in New York, and when my engagement with that company was ended, and after a year or more spent in futile attempts to make a living by office and other work, in the fall of 1870 I accepted the position of Associate Editor of the *Railroad Gazette*, which was offered to me by Mr. A. N. Kellogg, who then published that paper in Chicago. In 1871 the great fire occurred there and the publication office of the paper was temporarily — as it was then thought—removed to New York. Soon thereafter Mr. S. W. Dunning, who was Editor-in-Chief, and myself, each bought an interest in the paper, and a year or two thereafter bought the whole of it, each of us owning a half. In editing the paper, my department was that of engineering and mechanical matters, while Mr. Dunning had charge of the transportation and traffic department and general railroad news.

In 1873 we obtained a copy of Georg Kosak's excellent little book on the locomotive, written in German. Mr. Dunning, who reads that language, agreed to translate the book and proposed that I should revise and adapt it to American practice, and that the translation should then be published serially in the *Railroad Gazette* and in book form thereafter. The translation was made and submitted to me for revision and adaptation, according to the original intention. Before that I had planned and had commenced writing an elementary treatise on the locomotive. In revising the first chapter of the translation of Mr. Kosak's book, it was found that it occupied only, to a very limited extent, the ground which in my incomplete plan I hoped to cover. Therefore the original intention of "adapting" Mr. Kosak's work was abandoned, and the whole book was rewritten and published in book form thereafter. In writing it, the aim was to explain the principles, construction and operation of locomotives in the simplest and clearest language possible, so as to be easily comprehended by engineers, mechanics, firemen and apprentices who have had few educational advantages. The only mathematics employed, excepting simple arithmetic, was one algebraic formula, and that might have been omitted.

The book seemed to supply a need, and at once had a large sale, which has continued ever since. It was rewritten and enlarged in 1889, and the demand for the revised edition still continues.

In 1872 I became an associate member of the American Railway Master Mechanics' Association, and in 1873 of the Master Car Builders' Association. About the same time—or perhaps earlier—I

was elected a member of the American Society of Civil Engineers, but resigned a few years ago. I was one of the organizers, and am still (1903) a member of the American Society of Mechanical Engineers.

The work of these associations, especially the two devoted exclusively to railroad engineering, was of great interest to me, and for years I took an active part in their proceedings, as is shown in their early annual reports.

By way of explanation, it may be said that away back in the seventies before any system of transit, more rapid than horse cars, existed in New York, that its population and daily papers, every winter, were thrown into paroxysms by each severe snowstorm which obstructed traffic in the streets and made it very difficult for people to be transported up and down town mornings and evenings. During such periods all kinds of wild projects were proposed for systems of rapid transit above, below, and in the streets of the city. In September, 1874, during such a period of exacerbation, at my suggestion, Mr. Octave Chanute, then Chief Engineer of the Erie Railroad, introduced a resolution at one of the meetings of the American Society of Civil Engineers, "that a committee of five members of the society be appointed by the president to investigate the necessary conditions of success, and to recommend plans for:

"First—The best means of rapid transit for passengers, and

"Second—The best and cheapest methods of delivering, storing and distributing goods and freight in and about the city of New York . . . and to report thereon."

The resolution was adopted, and a committee consisting of Mr. Chanute, Ashbel Welch, Gen. Charles K. Graham, Francis Collingwood and myself were appointed.

Although there were three other members of the committee, Mr. Chanute and myself did most of the work of preparing the report. We each of us devoted a great deal of time to collecting and tabulating data relating to the subjects submitted to the committee for investigation, concerning which there had then been very litle reliable information published. The old Greenwich street elevated railroad had been built from the Battery up to Thirtieth street, on Ninth avenue, and had then abandoned the use of a cable, which was first used by Mr. C. T. Harvey for transmitting the motive power to the cars, and a small four-wheeled locomotive had been substituted for the cable. This was then the only thing approximating to "rapid transit" in the city of New York. The only data obtainable concerning the probable traffic and expenses of a real "rapid transit" road was from this line, and those operated on the surface of the streets; the motive power of all of the latter was then horses.

In the report made it was said: "The committee deemed it necessary, as a preliminary basis, to ascertain what would be the probable earnings and expenses of rapid transit roads, and in what amount of capital the net revenue thus estimated would pay a fair rate of interest. The usual methods of assuming the operating expenses to be a certain percentage of the earnings seemed to us quite worthless when applied to roads possessing so many features of novelty. During the progress of this inquiry, therefore, two of the members of the committee made careful estimates, from the best data they could obtain, of the possible revenues, and of the cost of running trains furnishing the required accommodations. These computations were entirely independent of each other. . . . The result was gratifying. Although carried by somewhat different processes, the final computations agreed so closely as to give the committee confidence in the approximate correctness of their estimates."

The conclusion which was reached was: "That the traffic on rapid transit roads would in a few years be equal to 35,000,000 passengers per annum, on each side of the island, and that it would warrant an expenditure of about $935,000 per mile of road."

The last (1902) annual report of the Manhattan Elevated and the Interborough lines shows that 246,587,022 passengers were carried in the year covered by the report. When our committee in 1875 ventured to estimate that "the traffic on rapid transit roads would, in a few years, be equal to 35,000,000 passengers per annum, on each side of the island," or a total of 70,000,000, this "estimate" of the committee was regarded as wild and visionary.

The report was completed and read at a meeting of the Society held on February 3, 1875. It was received with a perfect storm of opposition and denunciation by members, some of whom had for years been recommending and lending their names and influence to different schemes for rapid transit railroads. The report was, however, printed by the Society. Legislation was then pending in Albany, which led to the appointment of what was known as the "Tilden committee," whose investigations and report was followed by the enactment of a Rapid Transit Act under which the existing Elevated roads were built. The report was placed in the hands of that committee and had much influence in shaping legislation and guiding those who directed it. The value of the work which the committee did, however, was never recognized, although it served to shape legislation and guide those who afterward built the elevated roads, and resulted in great advantage to their projectors and the public generally.

The appendix which I wrote for the report contained the recommendation, "that no authority should be granted to any company to build a rapid transit railroad without the express stipulation *that not more than half-fare should be collected unless the passenger is provided with a seat on demand.*" My recollection is that such a just and salutary provision was inserted in the original bill, but was eliminated before it finally passed the legislature.

After being a member of the Master Car Builders' Association for a number of years and taking an active part in its work, it became apparent to me that there was a great deal of work which such an association ought to do, but which could not be done unless some direct relations existed between it and the railroad companies, whose interest it should represent. At the same time, it was evident that any important change in the existing conditions of membership would be defeated if proposed to the Association. In this dilemma, to quote from a report made in 1889, "the idea was conceived of leaving the conditions of membership the same as theretofore, but of creating a new class of members to be appointed by the Presidents, General Managers or General Superintendents, to represent the railroad companies in the Association, such members to have a vote proportionate to the number of cars owned by the companies they represented. This measure was proposed to some of the older members, including Leander Garey, F. D. Adams, and others, and approved by them.

After much negotiating, many reports and a great deal of discussion, such a measure was finally carried and ultimately resulted in all the principal railroad companies in this country and Canada appointing what were called representative members.

It was carried, however, in the face of very strong opposition, but its salutary effect upon the Association and its effectiveness at once became apparent, and the beneficial results have increased every year since.

A full account of the reorganization of the Association was given in my final report to the Association as Secretary in 1889. In that it was said: "The influence of the Association has been very much widened and strengthened by the reorganization, which has given to railroad companies a representation in its deliberations."

After the reorganization in 1882, I was appointed Secretary of the Association and held that position until 1889. The work interested me very much, and perhaps by aiding in the adoption of standard forms and methods of construction of cars, and the introduction of safety appliances, some good may have been accomplished. At any rate, the work which was commenced then has been followed up by other people and other agencies—notably the Interstate Commerce Commission—so that there is the satisfaction of having helped in a movement which has greatly lessened the loss of life and limb in railroads.

Early in the history of the Master Car Builders' Association the confusion of names used to designate the different parts of cars attracted attention, and in 1871 a committee was appointed to prepare a "Dictionary of Terms used in Car Building."

In the preface of the "Dictionary" which was subsequently published, it is said:

"This committee originally consisted of eight or ten members, who held a number of meetings without accomplishing much, and it soon became apparent that it was too unwieldy to do the work which had been undertaken." It was finally narrowed down to Leander Garey, Calvin Smith and myself. I did the writing and the other members acted as consulting members of the committee. We held many meetings, and the preparation of the first edition of that book was a long and tedious work. The book was, however, finally completed, and published by the *Railroad Gazette*. Several new editions have been issued since.

Mr. Dunning and myself continued to publish the *Railroad Gazette* until the end of 1883. I then sold my interest to W. H. Boardman, who had been business manager of the paper for a number of years. In a valedictory editorial, with the title "Some Last Words," published in the *Railroad Gazette* of Dec. 28, 1883, it was said:

"The work of editing a journal like the *Railroad Gazette* is not only severe, but unremitting. Every week brings its tasks, and there is no opportunity for recuperating exhausted energies, however serious the need may be. * * * When it became apparent that the editorial steam gage could no longer be kept up to working pressure, the question had to be decided whether it would be wisest under the circumstances to diminish the loads and continue at work until the mechanism was fit only for the scrap heap, or whether it would be best to uncouple from the train entirely and lay up for thorough repairs. The latter plan is the wisest course to pursue with locomotives, and is the one which the master mechanic who superintends the repairs to the writer insisted must be adopted in his case, or the machine would soon be too dilapidated for any further service.

"And thus a career commenced with much hope, pursued with more than a little toil, is ended with some disappointed anticipations, but with many pleasant and some tender recollections."

For three years thereafter—my life seems to have been divided

into cycles of three years—I was not engaged in any regular business. Doing nothing soon grew wearisome, and in the latter part of 1886, for the sake of having regular occupation, I bought the *American Railroad Journal* and Van Nostrand's *Engineering Magazine*, and on the first of January consolidated the two publications under the name of *The Railroad and Engineering Journal*. That paper I published and edited until the end of 1895, but changed its name at the beginning of the year 1893 to the *American Engineer and Railroad Journal*. The enterprise, however, never was financially successful, and on Jan. 1, 1896, my interest in it was sold to R. M. Van Arsdale, the proprietor of *The National Car and Locomotive Builder*, who then consolidated the two publications. Part of the agreement in making the sale was that I should edit the new paper for one year.

Since that time I have not been in any regular business, although much occupied in different ways and on a variety of matters.

Invention has always had a great fascination to me as it has many others. It is akin to the passion which the fortuity of gambling has to a gamester, and once having developed the taste for invention its allurements have led me on, as will be shown by the following list of patents which have been granted to me, and which will indicate the subjects in which my efforts to improve things have been exercised:

List of Patents to M. N. Forney.

No.	Date.	Title.
52,406	Feb. 6, 1866.	Locomotives.
247,034	Sept. 13, 1881.	Interlocking switch and signal apparatus.
250,517	Dec. 6, 1881.	Railroad signaling apparatus.
266,802	Oct. 31, 1882.	Railway tell-tale.
266,685	Oct. 31, 1882.	Locomotive engine.
17,949	Oct. 24, 1883.	Improvement on locomotive engine (Canadian).
324,825	Aug. 25, 1885.	Car seat.
354,631	Dec. 21, 1886.	Furnace doors.
360,148	Mar. 29, 1887.	Car seat.
408,004	July 30, 1889.	Locomotive engines.
414,035	Oct. 29, 1889.	Railroad car bodies.
436,055	Sept. 9, 1890.	Safe depositories for railroad cars.
472,039	Apr. 5, 1892.	Fire grates.
482,447	Sept. 13, 1892.	Reversible backs for car or other seats.
485,344	Nov. 1, 1892.	Locomotive engine.
488,992	Jan. 3, 1893.	Reversible backs for car or other seats.
489,648	Jan. 10, 1893.	Counterbalance and guides, reciprocating mechanism
510,636	Dec. 12, 1893.	Steam boilers.
518,399	Apr. 17, 1894.	Steam boilers.
527,842	Oct. 23, 1894.	Car seats.
527,960	Oct. 23, 1894.	Locomotive axle boxes.
528,294	Oct. 30, 1894.	Means for counterbalancing momentum of reciprocating mechanism.
20,808	Oct. 30, 1894.	Improvement in steam engines (English).
557,794	Apr. 7, 1896.	Valve gear.
566,675	Aug. 25, 1896.	Car seats.
632,708	Sept. 12, 1899.	Feed water heaters for steam boilers.
661,690	Nov. 13, 1900.	Multiple address envelope.
688,402	Dec. 10, 1901.	Feed water and steam heaters for steam boilers.
701,477	June 3, 1902.	Means for counterbalancing the momentum of reciprocating elements.
735,739	Aug. 11, 1903.	Fluid pressure engine.
735,740	Aug. 11, 1903.	" " "
735,741	Aug. 11, 1903.	" " "
735,742	Aug. 11, 1903.	" " "

Of the patents on tank locomotives, mention has already been made. Thus far the only other of these patents which have been profitable to me are some of those on car-seats. These for a time yielded me considerable income. Some of the rest, I feel sure, would have done so if sufficient effort had been made to introduce them, or, in other words, if they had been properly "pushed" commercially. Of the ultimate success of those, which still have any considerable term of existence, it is, of course, impossible to predict. It may, however, be well to make a confession here of a consciousness of a deficiency of the kind of capacity needed in selling things, and a constitutional abhorrence of anything relating to what is called the "solicitation of business." Probably if as much effort had been exerted, to the introduction of some of my inventions as was exercised in devising and perfecting their mechanical features, they would have been more or less successful and perhaps profitable. The mechanical development of my various schemes has been intensely interesting to me, whereas the effort required to introduce them has always been more or less obnoxious.

Besides a disposition to improve mechanism of various kinds, I have also had an inclination to improve social and political affairs, and to that end, have been a member of the American Free Trade League and American Peace Society in Boston, the Citizens' Union and Anti-Imperialist League of New York, and have been a member of the Executive Committee of the latter. I am also a member of the Union League, the Century, the Engineers' and the New York Railroad Clubs. In 1898, the American Railway Master Mechanics' Association did me the honor to elect me an "honorary member." My associate membership dated back to 1872, and that in the Master Car Builders' Association to 1873. The latter elected me a life member in 1890.

Besides the two mechanical books already referred to, in 1894 when the Constitutional Convention of the State of New York was in session, I wrote a book with the title "Political Reform by the Representation of Minorities," with the purpose of influencing that convention to make some form of Proportional Representation possible in this state. It failed to accomplish that purpose, and apparently has had little or no other influence. Later I wrote and published two pamphlets, one with the title "Proportional Representation; A Means for the Improvement of Municipal Government," and the other, "Minority Representation in Municipal Government." If any of these ever produced any effect it has not yet been made apparent to me. Writing them, however, gave me some diversion, and it, of course, may be that it is a case of "bread cast upon the waters." I have had and still have a strong conviction that the most effective means of improving national, state and municipal government, would be some form of proportional or minority representation, which would place it in the power of portions of people, less than a majority, to represent their views and interests. The justice of such a measure does not seem to be suited to the apprehension of popular intelligence, or perhaps it should be said, popular ignorance.

During the most active part of my life, I often made the mistake of undertaking too much, and now the consciousness is distinctly felt of having had too much work and not enough play during many of the past years.

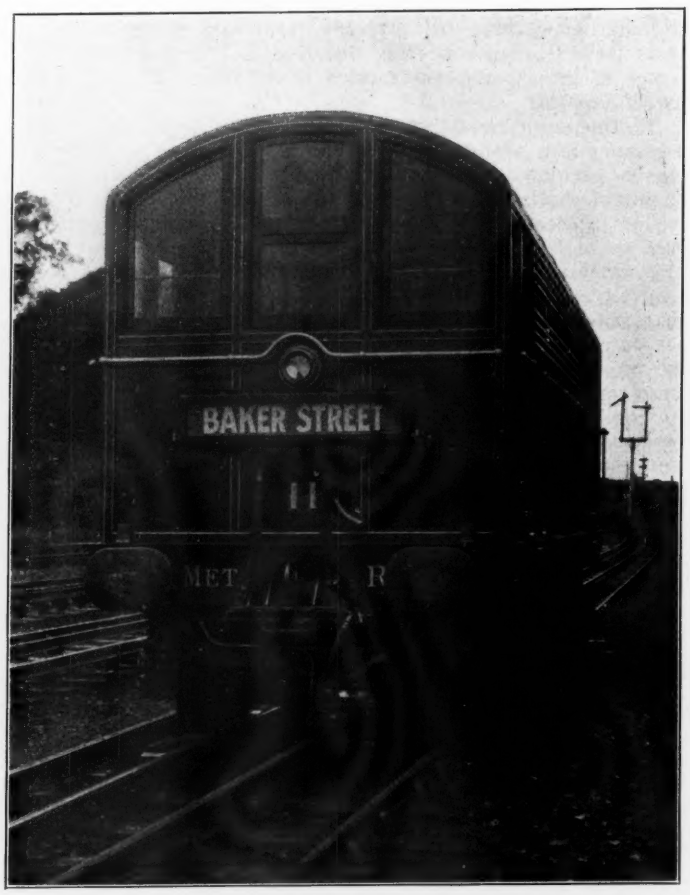
Perhaps some men, and all women, who see these notes, will be curious to know why no woman was ever asked to share my joys and sorrows. It would not be difficult to give an answer, which would be somewhat like this—during the impressionable period of my life I could not afford to assume such a partnership; when things went better with me my time was too much occupied to give the matter the required attention, and later, by reason of age, attractive women would not smile on me. It would do no good to admit now that it was a mistake to live alone, but it is also true that celibacy has its compensations.

This brings the summary of life up to the present time, August, 1903. Someone else must add the date when it will be ended.

Electric Locomotive for Passenger and Freight Service; Metropolitan Railway, of London.

Of the ten electric locomotives for passenger and freight service which are being supplied by the British Thomson-Houston Co., Ltd., of Rugby, to the Metropolitan Railway Company, of London, three have been delivered.

These locomotives are of the double bogie type with box-wagon



Front View of Electric Locomotive; Metropolitan Railway.

shaped cab, and weigh, in running order, 47 tons. The motors with which they are equipped are of the GE 69 type with one-turn armatures, the gear ratio being $^{64}/_{19} = 3.36$. One motor is mounted on each of the four axles. They are of 200 h.p. each, and weigh, complete with gearing and gear case, approximately, 6,100 lbs. They are of the box frame type with nose suspension. The internal construction is of B. T. H. standard practice.

The control is the Sprague-Thomson-Houston multiple unit sys-

tem, and is similar to that used on the passenger trains equipped for the Metropolitan Railway by the B. T. H. Co.

The collector gear consists of twelve shoes arranged as follows: Two positive shoes in parallel on each side of each truck which are supported by oak beams bolted to the axle boxes. There are four negative shoes, one being attached by a suitable insulated bracket to each motor.

Side View of Electric Locomotive; Metropolitan Railway.

The following are the leading dimensions:

Gage	4 ft.	8½	in.
Length over cab and headstocks	30 "	0	"
Length over buffers	33 "	6	"
Centers of bogies	17 "	0	"
Wheel base of each bogie	7 "	6	"
Width over cab	8 "	0¼	"
Width over side sills	8 "	0	"
Width over all	8 "	7	"
Height from rails to top of cab	12 "	3⅞	"
Height from rails to top of floor	4 "	7½	"
Diameter of wheels	3 "	2	"
Diameter of axles:			
At center and in motor suspension bearings		6½	"
At gear wheel seat		7½	"
At wheel seats		7 1/16	"
At truck journals		5½	"
Length of journals		9	"

Trucks.—These are of the pressed steel type strengthened with reinforcing plates, steel angles and gussets; they are fitted with a swinging bolster, built up with steel sections and steel castings. The bolster is supported on two nests of coil springs of circular section, each nest consisting of three springs. The bolster is also provided with cast steel wearing plates, center and side bearing plates. The side frames are supported on the axle boxes by laminated springs of heavy design. The axle boxes are of steel castings, machined to work in the horn plates, which are also of steel castings and machined, being riveted to the side frames which are cut out to receive them. The side frames are further strengthened at this point by a doubling plate. The axle boxes are provided with removable fronts, each front of which is fitted with an inspection door. The bearings are of anti-friction metal. The axle boxes are provided with lugs at the bottom to which the collector shoe beams are attached. Ample provision is made for lubrication and the exclusion of dust. The brake gear is of the inside type, one block per wheel being provided, the whole being of specially heavy design so as to stand operation by both power brakes simultaneously. The wheels have centers of wrought iron with nine open spokes forged into them, and are fitted with rolled steel tires 5 in. wide by 3¼ in. deep, held in place by retaining rings, and also by four set screws. The motors are carried on the transoms by means of cast steel brackets riveted thereto, in which the nose on the motor rests, being held there by a forged strap. Collector shoe beams are of oak and bolted to the axle boxes on each side of each truck, the collector shoes being hung inside the wheel base.

Underframe.—This is constructed of steel members of sufficiently heavy section to bring up the locomotives to the weight desired. Each side sill is formed by a channel 12 in. x 3 in. x ½ in. section connected together at the ends by head stock channels of the same section. The underframe bolster is formed by two channels 10 in. x 3½ in. x ½ in. section, and between the two bolsters there are two crossbars of channel section 10 in. x 3 in. x ⅜ in. Between headstocks, bolsters and crossbars there are two longitudinal channels parallel to one another of 10 in. x 3 in. x ⅜ in. section. To further strengthen the ends of the frame against buffing strains there are two struts, diagonally placed, of channels of 10 in. x 3 in. x ⅜ in. section. The whole frame is firmly riveted together with steel angles and gussets. The top of this main underframe is covered with steel plate ¼ in. thick. Above this is a sub-floor 6 in. deep, formed by channels, in which is laid the whole of the piping containing the wiring, besides the piping for the brakes. On the top of this sub-floor is a floor of steel plates ¼ in. thick made in removable sections. At each end of the driving positions and down the center of the locomotive this floor is covered with wooden walking grids ⅞ in. thick. At each end of the underframe are

Control Apparatus in Cab of Electric Locomotive.

Interior Arrangement of Electrical Apparatus.

placed buffers and draw hooks with screw coupling, of standard English pattern, besides a central automatic coupler, so that the locomotives can be used for hauling either standard coaches or electric stock.

Cab.—The cab, of the box-wagon shape with curved roof, is constructed of steel plates ⅛ in. thick riveted to supporting vertical and longitudinal angles, which are in turn riveted to the underframe. The upper portion of the cabs on each side between the doorways are fitted with louvres of pressed steel for ventilation. All lines of rivets are covered with neat metal mouldings so as to improve the appearance of the outside of the cab. At each end of the cab there are four movable windows, three being dropping lights, and one hinging inwards. There is also one dropping light at each side, in the corners.

Hinged doors are fitted at each side of the locomotive at the ends, there being two single doors and two double doors, the double doors for use whenever it is necessary to remove the exhausters, compressors, etc., from inside the cab. All windows are glazed with $^{3}/_{16}$ in. glass, the doors being fitted at the bottom with steel frames.

The locomotive is fitted at each end with complete driving equipment consisting of master controller, provided with "deadman's" handle, air and vacuum brake, driver's valves, starting switches for exhauster motors, valves for air operated whistle and sanding gear, air and vacuum gages and ammeter; also at each end of the cab to the right of the driving equipment is fitted a column to carry the hand brake gear.

The control and brake equipment is as far as possible divided into two sets and placed on either side of the locomotive, leaving a gangway down the center. The control itself is entirely divided into two sets, one set for each two motor equipments.

Taking each side of the locomotive, the arrangement is as follows:

On one side, switchboard containing the necessary main, control and cut-out switches, compressor motor switch and main lighting switch, control gear consisting of contactors, resistances and circuit breaker, all mounted on a strong steel frame rigidly connected to the cab sides and underframe. Underneath this is fixed the reverser. The air compressor, main air and vacuum reservoirs are placed in line with the supporting frame.

On the opposite side of the locomotive, looking from the same end, are arranged two motor-driven vacuum exhausters, and control gear on framework, arranged as above, together with switchboard containing the necessary control switches, etc., with the addition of the main switches for the vacuum exhausters. The auxiliary reservoir for the air brake is fixed in the cab over the exhausters.

The air brake is of the quick-acting pattern, air being supplied by a B. T. H. electrically-driven compressor of the C. P. 23 type. This set will operate against a pressure of 90 lbs. per sq. in., and has a cylinder displacement of 50 cu. ft. per minute.

In connection with the vacuum brake, there are provided two exhausters each electrically-driven by a B. T. H. type D A motor. One of these exhausters is used for creating the vacuum when starting the train, the other (continuously in operation at half speed) for maintaining the vacuum whilst running.

In the underframe there are fixed two air brake cylinders of the vertical type, 13 in. diameter, and two vacuum cylinders, 22 in. diameter. Immediately under the above are two transverse rocking snafts to which the pistons of the cylinders are connected, viz.: one air and one vacuum to each shaft; each set in turn being connected to the rigging for one truck. It should be noted, however, that the hand brake wheel at either end of the cab operates the brake rigging on both trucks.

Trip cocks, one for air and one for vacuum, are fitted on each truck.

Power sanding gear is provided, a sand hopper being fitted at each end of the locomotive in the cab, under which is fixed a combined air and sand valve, the sand and air being carried by a flexible pipe to the fixed delivery pipes on the leading end of each bogie.

Lighting.—Four lighting circuits are provided, one of five lamps placed in the roof down each side of the locomotive, and one of five lamps at each end of the locomotive, the distribution of the light in the latter being four lights in the destination indicator and one in the headlight. All the lamps are of 16 c.p. and are arranged for working five in series on a 600 volt circuit. Provision is also made at each end of the locomotive for the reception of the necessary oil signal lamps to suit the traffic requirements.

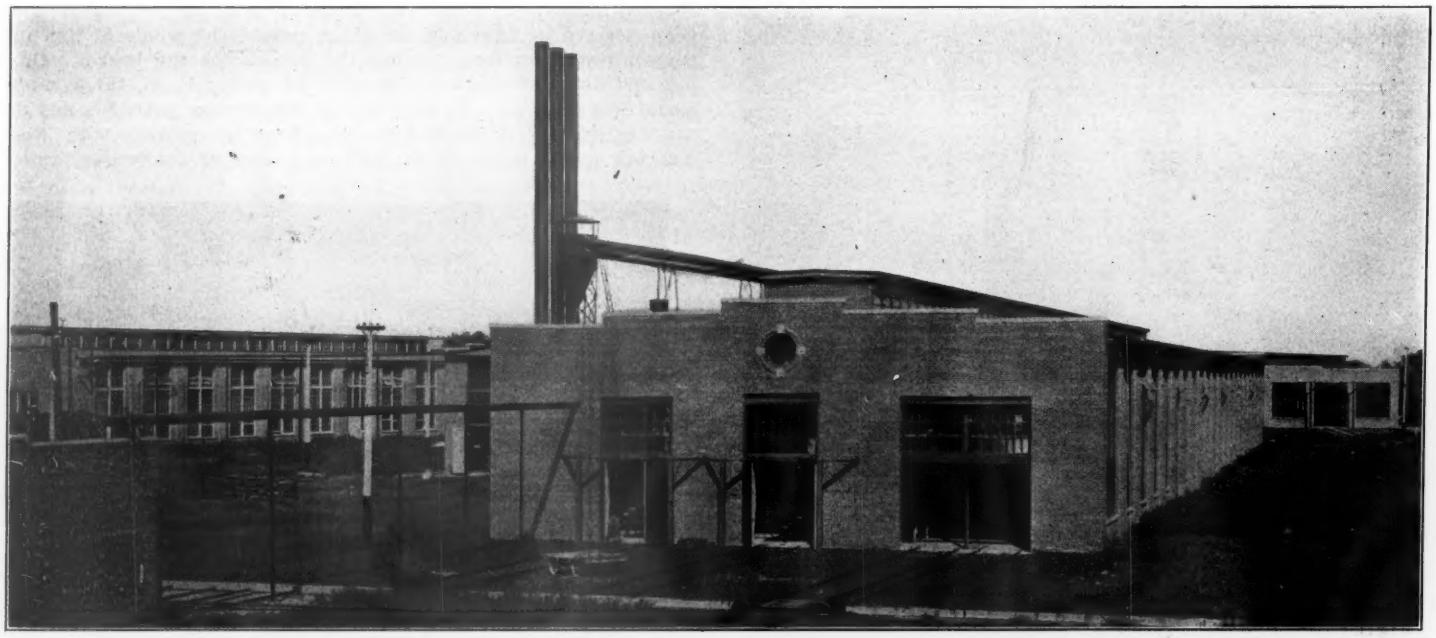
Wiring.—All cables are asbestos covered, and are run in drawn steel tubing fitted in the sub-floor wherever possible. The connection between contactors and rheostats are of copper rod. The necessary connection boxes are fitted in the sub-floor and underframe for connecting to the motors and collector shoes.

Capacity.—Each locomotive when operating on a 600 volt circuit is capable of hauling a 120-ton passenger train on the level at a speed of 35 miles per hour, and of starting with the same load on a grade of 1 in 44, also of hauling a 250-ton goods train up a grade of 1 in 44 and starting with the same load on a grade of 1 in 90.

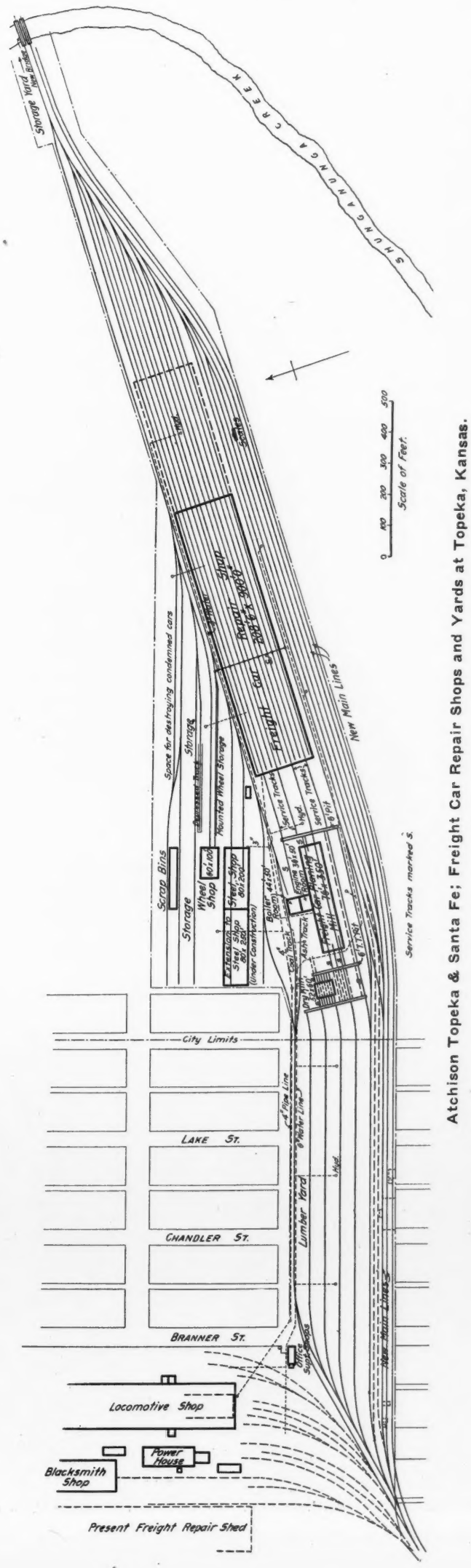
New Freight Car Repair Shops of the Santa Fe.

The great growth of freight traffic on the Atchison, Topeka & Santa Fe has made it necessary to provide facilities for repairing a greater number of freight cars with a shorter average detention than heretofore. For the past 10 years repairs to freight cars at Topeka, the largest shops on the system, have been made in a large shed run in conjunction with the passenger car repair shops. One planing mill and one wheel shop served both. But the need for larger and more modern facilities was so great that a new group of buildings has been provided for repairing freight cars only, and this work now is separated entirely from the passenger car work. Each of the departments is in charge of a general foreman who reports directly to the superintendent of shops.

The new buildings are, freight car repair shop, 208.5 ft. x 900 ft.; planing mill, 76 ft. x 350 ft.; power house, 50 ft. x 80 ft.; steel car repair shop, 80 ft. x 450 ft.; wheel shop, 60 ft. x 100 ft.; lavatory, 16 ft. x 36 ft.; dry kiln, 52 ft. x 60 ft. These buildings are located along the north side of the main line tracks just east of the older plant. Considerable land had to be bought to provide room for them, some of it improved residence property. Not all of this has yet been vacated, as the accompanying plan of the new group shows. The main line of the road also had to be moved southward. It formerly ran through the site of the freight car



Planing Mill, Structural Street Shop and Power House on Left; Freight Car Shop Beyond on Right.



Atchison Topeka & Santa Fe; Freight Car Repair Shops and Yards at Topeka, Kansas.

repair shop. The new buildings are brick with wooden roof framing and tar and gravel roofing.

The freight car repair shop, with roof of the familiar train-shed type, is plentifully supplied with windows, there being 40,000 sq. ft. of glass in the roof and walls, giving ample light. The roof is supported by wooden posts. The brackets for the scaffolding are attached directly to these posts and are so made that the lower or supporting member can be unfastened and the bracket swung down at the side of the posts out of the way. This leaves more room for handling heavy material to and from the cars.

There are 12 tracks running lengthwise through the building. Eight are repair tracks and four are material tracks, one of the latter supplying two repair tracks. There is a total of nearly two miles of tracks in the shop, with room for 140 cars, allowing 50 ft. of repair track to a car. On each side of the material tracks are bins and racks for bolts, nuts and other small material, so placed that the workman will always be within easy reach of whatever small supplies he needs. The material tracks are planked for convenience in handling small hand trucks, but the rest of the floor is surfaced with finely crushed stone. This is wet down about once a week, which keeps it hard and smooth and in good condition.

Outside of the shop, along the south side of the building, are well-arranged racks and bins for such large forgings and castings as cannot be accommodated inside. Material which is liable to damage by the weather is stored at the west end of the shop, between it and the planing mill. The distance between these buildings is 250 ft. and a large part of this is to be roofed over for the protection of this material. Repaired cars are painted outside of the shop on the first two tracks south, compressed air being used where possible.

Practically all of the car repairers work by the piece. The only exceptions to this are the "students," who are paid by the hour until they have become proficient enough in the use of their tools to warrant their being changed to piecework. The car repairers are worked in gangs of four, a leader being in charge of each gang. The work which each gang reports completed is checked by a timekeeper, who also figures the earnings of each gang. The earnings are divided equally among the members of the gang. Each leader has the privilege of choosing his own co-workers. This method has proven very satisfactory as it combines the good men into gangs by themselves and puts the poorer ones into less efficient and lower-paid groups.

It is the intention to make only heavy repairs in this building. The working force is to be increased in the near future to 400 men, including laborers, and the output will be between 50 and 60 extra heavy repairs a day.

Just west of and in direct line with the freight car shop is the planing mill. This is a modern building equipped with new machinery throughout and has capacity to prepare daily, without over-crowding, between 40,000 and 50,000 ft. of finished lumber for repairing freight cars. The shavings exhaust system is worked by 60-in. single exhaust fans, feeding to the fireboxes of three 150-h.p. return tubular boilers. No other fuel is necessary. Power for driving the mill is supplied by a simple Corliss engine built at the shops from designs furnished by the Allis-Chalmers Company.

North of the planing mill is the structural steel car shop. It has a capacity of eight cars and is supplied with all the necessary forges, etc., for handling the work. A traveling crane of 2,000 lbs. capacity supports a portable pneumatic riveter. There is also space in this building for making heavy repairs to car trucks for the freight car shop.

The wheel shop is north of the structural steel shop. It does all of the freight wheel and axle work for the Topeka plant and also for many outside points. There are two wheel presses, one each for pressing wheels on and off the axles, and three axles lathes. The capacity of the shop is between 130 and 140 pairs of wheels a day. The depressed track for unloading wheels and axles and loading scrap and mounted wheels accommodates four cars. Mounted wheels are stored on a spur leading from the wheel shop along the north side of the main shop; trucks from the structural steel shop are handled in the same way, and both are run into the main shop on a crossover track.

The structural steel and wheel shops are run by a small Corliss engine in the former, steam being obtained from the planing mill power house near by. The main shaft extends through the wall to the wheel shop. A rope drive is used.

The drying kiln is west of the planing mill and at the head of the lumber yard. It is large enough to accommodate sills and all other lumber that must be seasoned under cover. The steam coils are supplied by heavily lagged overhead pipes from the power house. The doors are canvas. The lumber yard has five tracks, each about 1,000 ft. long, with spaces 50 ft. wide between them, giving room for the storage of a considerable supply of green lumber. At the extreme east end of the shop grounds are tracks for the storage of bad order cars, with room for 1,000 cars.

The shops were planned for the economical handling of material. The lumber yard, drying kiln, planing mill and freight car

shop lie practically in a line, and there is no reverse movement of material. The repaired cars are drawn from the east end of the shop. For such lumber as does not go through the dry kiln or planing mill, tracks pass outside of these buildings directly from the lumber yard into the freight car shop. All of the tracks from the lumber yard to the freight car shop, both outside and inside of the intermediate buildings, are connected transversely by three push car transfer tables, one placed respectively between the lumber yard and the dry kiln, the dry kiln and the planing mill, and planing mill and freight car shop.

The building of this freight car repair plant at Topeka is in line with the policy of the Santa Fe to centralize, as much as possible, repairs to cars and locomotives. The addition of these shops gives the Santa Fe the largest railroad shop plant west of Chicago.

List of Tools in Planing Mill.

1 12 in. x 30 in. double surfacer (Berlin).
1 10 in. x 26 in. double surfacer (Preble).
1 16 in. x 24 in. (No. 8) planer and matcher (S. A. Woods & Co.).
1 12 in. x 20 in. sill planer (J. A. Fay & Egan Co.).
1 12 in. x 26 in. surfacer (J. A. Fay & Egan Co.).
1 18 in. x 20 in. four-spindle boring machine (Greenlee).
1 10 in. x 20 in. single spindle boring machine (J. A. Fay & Egan Co.).
1 14 in. x 16 in. three-spindle boring machine (J. A. Fay & Egan Co.).
1 36-in. automatic knife grinder (Berlin).
1 36-in. automatic cut-off saw (J. A. Fay & Egan Co.).
1 36-in. railway cut-off saw (J. A. Fay & Egan Co.).
1 30-in. rip saw (Greenlee).
3 24-in. rip saws (Atch., Top. & S. Fe).
1 Band saw for 18-in. stock (Bentel & Margedant).
1 36-in. re-sawing machine (J. A. Fay & Egan Co.).
2 No. 3 automatic cut-off saws (20 in.) (J. A. Fay & Egan Co.).
1 9 in. x 9 in. universal woodworker, jointer and sticker (J. A. Fay & Egan Co.).
2 14 in. x 16 in. reciprocal mortisers with boring attachment (J. A. Fay & Egan Co.).
1 14 in. x 16 in. hollow mortiser (Greenlee).
1 16 in. x 18 in. rotary mortiser with boring attachment (J. A. Fay & Egan Co.).
1 6 in. x 15 in. large matcher (J. A. Fay & Egan Co.).
1 6 in. x 15 in. small matcher (J. A. Fay & Egan Co.).
1 6 in. x 15 in. matcher (Berlin).
1 10 in. x 16 in. large tenoning machine (J. A. Fay & Egan Co.).
1 10 in. x 16 in. combination tenoning and gaining machine (J. A. Fay & Egan Co.).
1 14 in. x14 in. sill tenoning machine (J. A. Fay & Egan Co.).
1 18 in. x 20 in. automatic gaining machine (J. A. Fay & Egan Co.).
1 Shaper, handles stock 3 in. thick (Atch., Top. & S. Fe).
1 Band saw filing machine for saws up to 2 in. wide (Detrick & Harvey).
1 10 in. double emery wheel.

New Freight Car Repair Shop at Topeka; Atchison, Topeka & Santa Fe.

Interior of Freight Car Repair Shop at Topeka; Atchison, Topeka & Santa Fe.

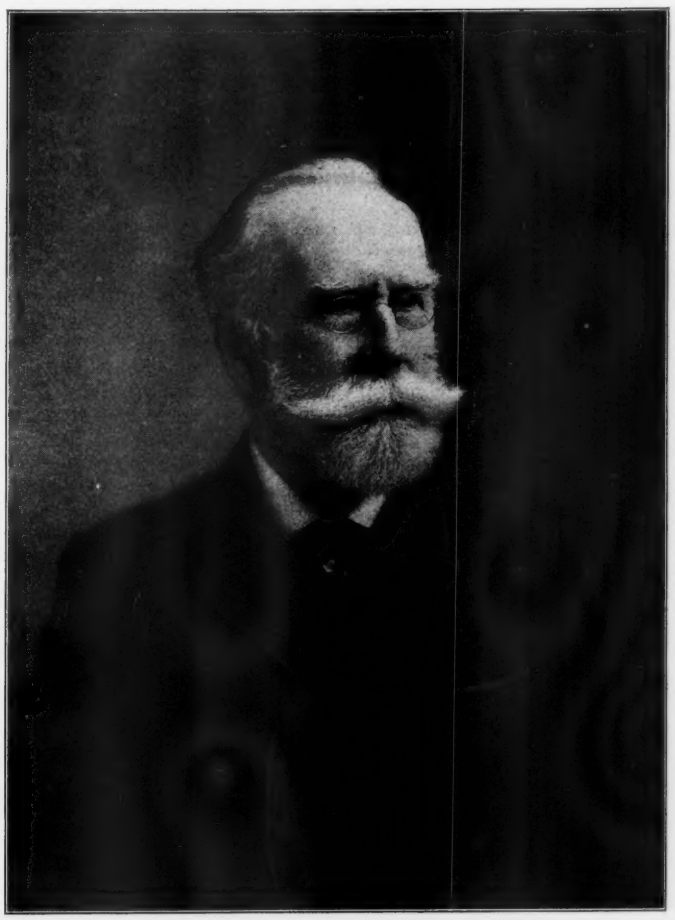
Coleman Sellers.

Dr. Coleman Sellers, one of the most distinguished mechanical engineers of the nineteenth century, both a scientist and an inventor, died at his home in Philadelphia, Pennsylvania, December 28, 1907, at the age of 81.

Dr. Sellers was born in Philadelphia, and in boyhood worked on a farm. His parents intended to have him live a farmer's life, but his mechanical bent was irresistible and during the two years that he worked on a farm he gave his time largely to improving farm implements. At the age of 19 he left the farm and went to work for his elder brothers in the Globe Rolling Mill at Cincinnati as draftsman, and from this time on the story of his achievements is a continuous record of important inventions rapidly succeeding one another. The story of his life, printed below, from the pen of the late president of Stevens Institute of Technology, gives the impressions of an associate and friend. Supplementing President Morton's narrative it should be noted that Stevens Institute conferred on Mr. Sellers the degree of Doctor of Engineering; and that the University of Pennsylvania made him Doctor of Science.

BY THE LATE DR. HENRY MORTON.

Coleman Sellers was born January 28, 1827. His father's family were among the earliest Quaker settlers of Pennsylvania, and his immediate ancestors were men of mechanical pursuits and respected and influential citizens. His mother was a daughter of Charles Wilson Peale, best known for his portraits of Washington and other officers of the Revolution, but also remarkable for the versatility of his talents, his mechanical skill, and his ingenuity. Dr. Sellers began his education in private schools in Philadelphia, and in 1838 entered the academy of Anthony Bolmar at West Chester, Pa., where he remained until his seventeenth year, distinguishing himself for his scholarship, especially in mathematics and the natural sciences, which had for him a marked attraction. * * * In his nineteenth year an opportunity was offered him in the Globe Rolling Mill in Cincinnati, then operated by his elder brothers, Charles and Escol. It was arranged that he should be the draftsman for the rolling mill, and his first work was in that line. He found his new business congenial, and he applied himself with ardor to mastering its details and with such success that we find him, before his twenty-first birthday, acting as superintendent of the plant, with entire control of its operation. The mills made wire bars, merchant bar and flat rails such as were then in use, and also drew iron telegraph wire. His brothers sold out their interests in the business, and in 1850 he was persuaded to join his brother Escol in building his patent hill-climbing locomotives and his "orograph," a mechanical surveying-machine for plotting contours; it was also a part of the scheme that they should instruct the young men in the mechanic arts. Three locomotives were built for the Panama Railroad and did good service there, although the third-rail grip—the hill-climbing feature—was not used. A few other locomotives were constructed, but the enterprise failed, and Coleman Sellers accepted a position in the Niles Locomotive Works in Cincinnati and soon became foreman. He reorganized the shop, subdivided the work, introduced an effective piece-work system, and radically changed the methods of manufacture, purchased and installed new machinery, and recorded in his diary that he was prepared to complete two engines a week.



Coleman Sellers.

These strenuous years of his young manhood were formative in a great degree in determining the bent of his mind and in giving him a fund of experience and a diversified practice which was of great value to him in his subsequent career. They were years of hard mental and manual work, often with primitive and inefficient appliances; but they developed his ingenuity and resourcefulness.

He read with interest the published accounts of electrical discoveries as they were from time to time announced by Faraday and others, and made for his own use the apparatus necessary to repeat many of the experiments for the benefit of his friends. Much of this apparatus is still in existence, and its marked excellence speaks well for his neatness and skill. He botanized, collected fossils and fresh-water shells, and in the latter pursuit his zeal and success were recognized by the distinguished conchologist, Mr. Isaac Lea, who named a new species from his cabinet *Melania Sellersiana* in his honor.

In 1850 he married the daughter of Horace Wells, of Cincinnati, a man of advanced mechanical ideas, who was first attracted to his future son-in-law by a lecture he delivered on "Scientific Fallacies," in which he demonstrated the conservation of energy and assailed, among others, a perpetual-motion scheme then very alluring to many otherwise sane persons.

In 1856 he removed to Philadelphia and entered the establishment of his kinsmen, William Sellers & Company, as chief draftsman and engineer. He applied himself with zeal to the duties of his new position, which afforded him ample scope for his marked inventive ability. His thoroughness, his originality and sound mechanical ideas, as illustrated in the productions of his firm and demonstrated in his published writings and his lectures, soon earned for him a distinguished position in the engineering world. As in Cincinnati he had identified himself with the Ohio Mechanics' Institute, so in Philadelphia he soon applied himself to the work of the Franklin Institute, and in a great measure helped, by his papers, lectures and committee work, to instil a new measure of vitality into that venerable society.

Dr. Sellers early took up photography, first as an adjunct to his business—to advertise machines—then as a pastime, and found in it a new outlet for his vigorous mental activity. He attained considerable proficiency and contributed many useful papers to the photographic press. He was for several years the American correspondent of the "British Journal of Photography," then the leading exponent of the art.

Dr. Sellers was admitted to partnership in the firm of William Sellers & Company about 1870, and upon its incorporation in 1885 was elected to the office of engineer. He remained with the house for over 30 years, retiring in 1887 to take up an independent practice as a consulting engineer. He has been granted more than 30 patents of utility and value, and the science of engineering is largely indebted to him for the great progress it has made during the last half century in the direction of increase of efficiency of machinery and mechanical appliances.

The versatility of Dr. Sellers has already been referred to. As additional evidence of this, and also the practicality which marked his original work in whatever line, may be mentioned the use of absorbent cotton for surgical operations, which was first thought of and recommended by him in his contributions to scientific journals as early as 1861. He also proposed the employment of glycerine for the purpose of keeping photographic plates moist; and it is interesting to note, in connection with the experiments in the early days of photography, that in the year 1861 Dr. Sellers invented and patented an apparatus in which figures in stereoscopic photographs could be seen as if in motion. Dr. Sellers' uncle, the late Franklin Peale, suggested the name "kinomatoscope" for this apparatus, which therefore, both in name and purpose, may be truly accepted as the parent of the "kinetoscope" of to-day, which has been made possible by instantaneous photography and subsequent improvements in electrical appliances. He had many avocations. Needing a microscope to study boiler scale he mastered microscopy and invented many improvements in that field. He used the telegraph to connect the different departments of the factory at Philadelphia and himself became a capable operator. He was also expert at shorthand. At the Centennial Exposition in 1876 he was one of the special judges for final settlement of disputed awards.

When Dr. Sellers retired from his position as chief engineer

with William Sellers & Company in 1887, he became a non-resident member of the Faculty of the Stevens Institute as Professor of Engineering practice, giving such time as he could spare from his practice as consulting engineer to deliver lectures on the actual practice of engineering.

In 1889 Dr. Sellers was called upon by capitalists to consider the practicability of the development and utilization of the hydraulic power of Niagara Falls. He was subsequently appointed to represent America in the International Niagara Commission of five members, with Lord Kelvin as chairman, which in 1890 was established in London to consider various methods of utilizing the power of the falls; and he became the active engineering head of the work, both as consulting engineer of the Cataract Construction Company, and president and chief engineer of the Niagara Falls Power Company. The important mechanical design of the large dynamos for the plant was the invention of Dr. Sellers, and they were built under his patents by the Westinghouse Electric & Manufacturing Company. Under his advice and directions important improvements have been made in the hydraulic machinery, and to his mechanical ability, sound judgment, and experience is largely due the success of the entire equipment and its freedom from costly methods so often met with in undertakings of this magnitude. In 1881 Dr. Sellers was appointed to the honorary Chair of Professor of Mechanics in the Franklin Institute of the state of Pennsylvania.

He is a member of the American Society of Naval Architects and Marine Engineers; member and past president of the Franklin Institute of the state of Pennsylvania; member and past president of the American Society of Mechanical Engineers; member of the American Society of Civil Engineers and of the American Philosophical Society; also of the Institution of Civil Engineers and the Institution of Mechanical Engineers, both of Great Britain; and corresponding member of the Society of Arts of Geneva, Switzerland.

In 1887 the Royal Norwegian Order of St. Olaf was conferred upon him by the King of Sweden in recognition of his valued services in his profession. He was one of the founders and for a time president of the Photographic Society of Philadelphia, and also of the Pennsylvania Museum and School of Industrial Art of Philadelphia. He was a member of the Seybert Commission of the University of Pennsylvania for the investigation of the claims of spiritualism, being chosen in consequence of his active and clear perception of the laws governing cause and effect, and his knowledge of sleight-of-hand in which art, as a pastime, he had been an expert since boyhood.

Railway Signal Association.

The regular meeting of this association was held at the United Engineering Societies Building, New York City, on Tuesday last, President A. H. Rudd in the chair. About 150 members were present, which is the largest attendance ever reported at other than an annual meeting.

The executive committee announced that under the revised constitution 22 railroads had appointed representative members of the association, the representative member in nearly every case being the signal engineer of the road. These roads are the Atchison, Topeka & Santa Fe; Baltimore & Ohio; Baltimore & Ohio Southwestern; Boston & Maine; Chicago, Rock Island & Pacific; Chicago, Indiana & Southern; Chicago & North-Western; Chicago, Milwaukee & St. Paul; Cincinnati, Hamilton & Dayton; Canadian Pacific; Delaware & Hudson; Delaware, Lackawanna & Western; Lehigh Valley; Maine Central; New York Central & Hudson River; Norfolk & Western; Pennsylvania; Pennsylvania Lines West of Pittsburgh; Philadelphia & Reading; Pittsburgh & Lake Erie; Seaboard Air Line, and the Staten Island Rapid Transit.

The first discussion was that on specifications for the installation of automatic block signals, taking up the report which was presented at the Milwaukee meeting last October, but which was not then discussed. Mr. Denny, Chairman of the committee, read the specifications paragraph by paragraph, and the meeting, resolving itself into a committee of the whole, discussed and criticised every word. As in former discussions of this kind, the differences of opinion which developed were legion, and the subject occupied the attention of the meeting until luncheon time. Votes were taken on a number of questions, but the conclusions reached have the effect only of suggestions to the committee—to guide it in making revisions for the next annual meeting.

In the afternoon the association listened to a paper by T. R. Cook, an electrical expert of the Pennsylvania Lines West of Pittsburgh, on Economy in the Use of Storage Batteries in Operating Signals and on the Details of Caring for Such Batteries. Mr. Cook is not a member of the association, but the paper was prepared at the request of a member. Statistics of service and of experiment were presented, showing the cost of operating signal motors by power derived from a power house conveyed by a line wire, and by primary batteries situated at the signals; and the principal conclusion was that for the average double-track road the cost by the power line will be 30 per cent. less than with the use of gravity batteries.

In the discussion Mr. W. H. Elliott thought that Mr. Cook had figured the cost of using gravity cells too high, and that the saving by using the power line would be greater than he had shown. Besides this there is a marked advantage in using a power line, with storage batteries, because of the greater freedom from failures. On a four-track line the saving in cost in using the power line is still greater. Mr. Cozzens told of the satisfactory service of a power line on the New York Central, where power is bought from the Niagara Falls plant. Mr. Gilmor told of the successful use of power lines on the Pennsylvania. Asked as to the greatest difficulty encountered in the use of storage batteries, he said that it was the need of better informed repair men. These men should be able to discover trouble in storage batteries by ocular inspection. They can see the batteries every day, whereas the battery expert cannot make inspections so often. Mr. Rudd said that in one case the charging line on the Pennsylvania had been out of service for a week, yet the storage batteries kept the automatic signals working satisfactorily. This, however, was with electro-pneumatic signals, requiring but little current. The Pennsylvania now uses cells of the 5E type, fixed at each signal bridge—a cell working a track circuit and a signal circuit. A four-track bridge requires eight cells, one for each track and four in reserve. Formerly "9-E" cells were used, each cell feeding two-track circuits; but this was not entirely satisfactory. On a busy four-track line cells are charged every night, and on lighter divisions three times a week.

On the Lake Shore & Michigan Southern, as reported by Mr. Denny, power plants, consisting of a 15-h.p. gasolene engine and a 10-kw. generator, are situated at intervals of about 15 miles, and each is used to charge two loops, one east and one west. This is a convenient length of line for a maintainer. Mr. Denny could give no complete statistics, but said that for the first 11 months the cost was about 20 per cent. less than it would have been with primary batteries.

The meeting passed a vote of thanks to Mr. Cook, the author of the paper, and referred it to the committee on storage batteries. The specifications for automatic block signals were then again taken up for discussion. The only radical difference of opinion developed was on the question whether an automatic semaphore should be so designed as to lock when in the stop position. One member had had a distant signal (standing in a horizontal position) pulled down by a painter and tied there for convenience in painting and then forgotten and left so as to send a train over a misplaced switch. The majority of the speakers, however, believed the lock undesirable.

In discussing the question of what metals should be used for bearings attention was called to the fact that new non-corrosive metals were now appearing on the market, so that a specification requiring the use of bronze for one of the two metals for bearings may be behind the times.

An informal discussion followed concerning the difficulty in arranging mechanical connections between cabins and signals, so that all switches can be bolt-locked by the signal connection. In large plants it is often necessary to run a circuitous line of pipe to comply with this requirement of the specification. Many members agreed that electric locking was the only practicable remedy.

Foreign Railroad Notes.

The Swiss union of railroad employees asks the state to raise the pay of the lowest grade of employee to $291 per year.

The Hungarian State Railroads purpose to buy three coal mines in different parts of the country to secure a better supply of fuel.

Trial trips have been made on a new railroad up the Wetterhorn, which is so steep it is called an "elevator," rising 450 meters in a length of 600, which is a "grade" of 3,960 ft. per mile, or 75 per cent.

Hungary is rejoicing over its first self-unloading car. It is for coal, built in Budapest, and apparently substantially after an American design, with trucks, but carrying only 44,000 lbs. It is for a 38-in. gage road, however.

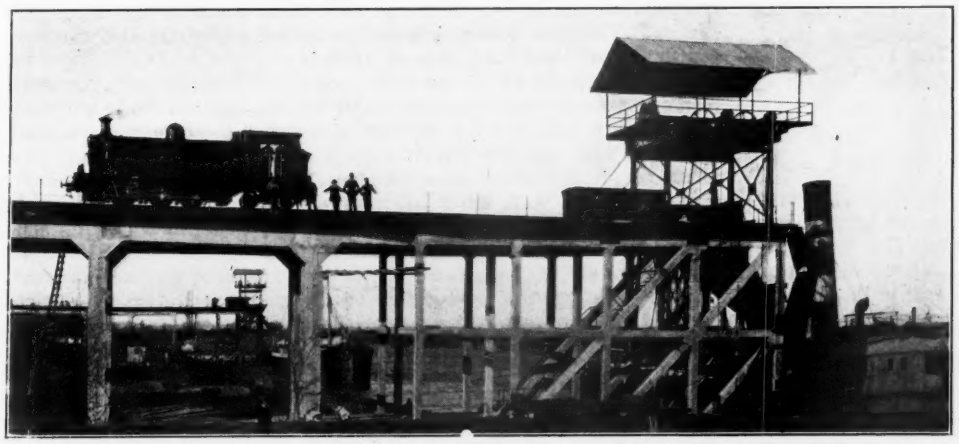
The project for pooling the rolling stock of the state railroads of the several German states, which was seriously discussed a year or two ago, has come up again, and is said to be likely to succeed, but limited to the freight car equipment.

The train-robber turns up in Germany adapted to the environment. He put on a conductor's cap, sidled along the foot-board until he came to a compartment where there was but one man, opened the door and asked to see the passenger's ticket; when the passenger pulled out his pocket-book with the ticket he knocked him senseless with a revolver and seized the pocket-book (which contained $8.33), and when next the train slowed down lighted out, and at last accounts had not been traced.

Reinforced Concrete Railroad Viaducts at Seville, Spain.

BY E. OMMELANGE.

The Spanish Cala Iron Company recently built a private railroad about 60 miles long from its mines in the interior to the port of Seville, where it ships ore by vessel. Its original plan for terminal docks in Seville included two timber loading wharves along the river, approached by timber trestles and earth embankments over the low ground between the river bank and the high ground further inland. Work had already been begun on this plan and some of the approach embankment made when the company decided to build the loading wharves of reinforced concrete instead of timber and instead of timber trestle and embankment approaches to use reinforced concrete viaducts. The change in plan was decided on because of the height of the approach viaducts necessary to carry the line from the high ground back from the river to the docks, the treacherous nature of the intermediate low ground and the necessity of making as small obstruction as possible to the flow of water across the flats during floods.



Reinforced Concrete Wharf With Car Dumper at Seville, Spain.
Second wharf and viaduct in left background.

The two wharves are about 600 ft. apart. The completed part of the embankment was made use of in building the approach viaduct to one of the docks. Nine spans of concrete viaduct were built between the end of the embankment and the wharf. The other viaduct approaching the second wharf is built entirely of reinforced concrete girder spans.

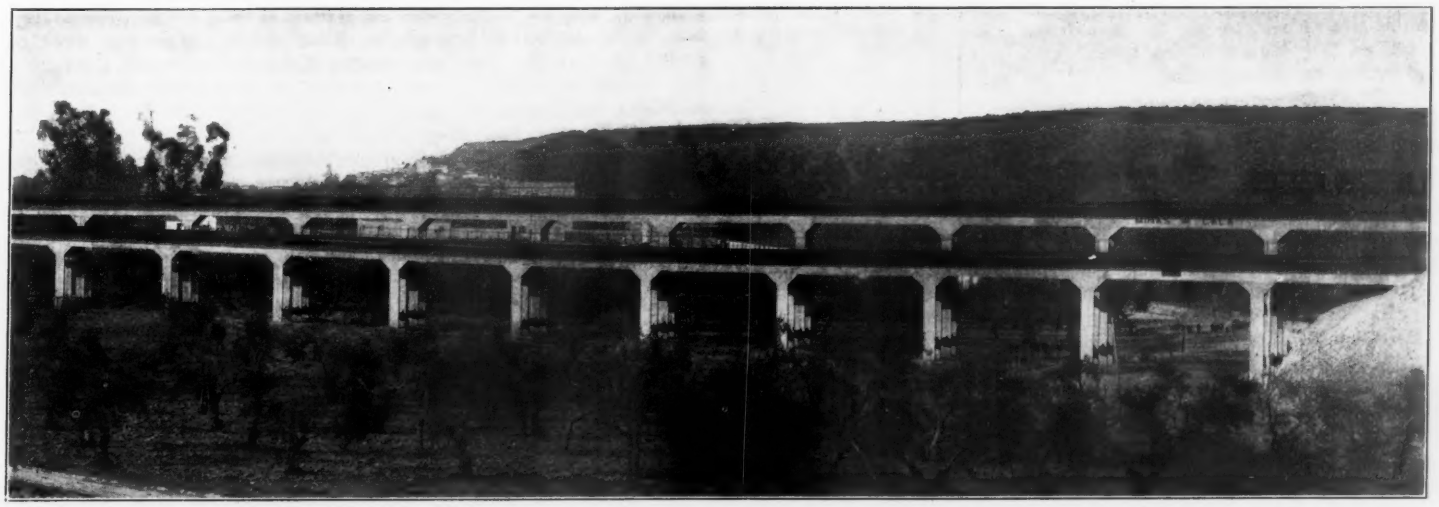
In general the concrete spans of both viaducts are similar. Each is double-tracked and is built in two levels. The upper level gives a slight down grade to the dock from the high ground back of the river. The track on the lower level slopes back from the dock and is used for returning empty cars by gravity to a storage yard at the inner end of the viaduct. The reinforced concrete girders are 4 ft. deep by 9 in. wide with a span of 29 ft. 2 in. between centers of supporting columns. There are two such girders under each track supporting a concrete slab floor 11 ft. 8 in. wide, on which a track of 3 ft. 4 in. gage is laid with 65-lb. rails on longitudinal stringers secured by bolts passing through the concrete floor. The girders and the supporting columns were built in the form of a monolithic structure.

The columns are rectangular, 23½ in. x 9 in. They are braced laterally at two levels, one 26 ft. 3 in., and the other 35 ft. above high water. Additional lateral bracing is provided for the high columns at about 42 ft. 7 in. above high water. Each lateral row of four columns supporting the two tracks rests on a reinforced concrete slab 22 ft. 2 in. x 5 ft. 9 in. x 8 in. deep, stiffened with ribs. This slab is in turn carried on a foundation block of ordinary concrete, 22 ft. 11 in. x 6 ft. 6 in. x 12 in. deep, giving a uniform bearing pressure on the ground of 1,000 lbs. per sq. in. under normal load and which may be increased to 2,200 lbs. per sq. in. if both tracks are supporting the weight of two loaded trains complete with their locomotives. The first six spans of one of the viaducts inland from the wharf are built in the form of a curve of 622 ft. radius which was made necessary in order to join the line to the other line back on the high ground.

The two wharves or docks were the most difficult part of the work. They consist of reinforced concrete columns, the highest of which are 89 ft. high, braced together by longitudinal and lateral girders and by diagonals in the three outer panels. One of the illustrations shows one of the docks in the foreground and the other dock in the background. The docks have two levels, one 17 ft. 6 in. above low water and the other 49 ft. 6 in. above low water. The upper platform is about 25 ft. wide and 75 ft. long. The floor is 8 in. thick and is designed to have a carrying capacity of 736 lbs. per sq. ft., or to support at any point a movable 10-ton crane. The lower platform is 5 in. thick and is designed to carry a load of only 184 lbs. per sq. ft. It is used for loading ore from light dump cars. The upper platform supports the large cars used in through transportation of ore and if necessary the locomotives, as shown in the illustration. The vertical posts and all of the diagonal and horizontal braces are 12½ in. sq. On the upper level of the dock is mounted a car dumping apparatus for unloading the cars direct into a spout leading to the hold of the vessel loading alongside.

The columns in the docks are supported on reinforced concrete piles 12½ in. sq. These piles were moulded and allowed to set two months before being driven. In building the first dock a pile driver with a tup weighing 2,500 lbs. was used and the piles sunk with the aid of a water jet. In driving the piles for the second wharf, however, no water jet was used, but the weight of the tup of the pile driver was increased to 6,000 lbs.

In the construction of the first viaduct and wharf the concrete moulds were made of timber and the scaffolding was erected and taken down as each panel was finished. It was found, however, that the tamping of the concrete into the moulds together with the caustic action of the cement and the changes from wet to dry and vice versa made the boards warp. Therefore, and because the spans were similar so that the same moulds could be used for the same parts on each, the moulds used on the second viaduct were made of sheet iron ⅛ in. thick stiffened with ribs of angle iron placed 1 ft. 8 in. apart. In this way the erection and dismounting of the moulds was hastened, the concrete ran better and the finish was smoother and finer. In a few instances this method could not be used and at such times specially stout timbers were selected. The moulds for the girders and the cantilever extensions were made in the same way.



Section of Two Reinforced Concrete Viaducts Leading to Wharf of the Spanish Cala Iron Company at Seville.

Before use, the whole structure was carefully tested. One of the spans of the first viaduct was loaded with rails placed so

as to correspond to the weight of a 48-ton locomotive. The deflection under this load was only $^1/_{10}$ in. after 72 hours. Another span was loaded with 72 tons, which is more than half again as much as the weight of the locomotive which is used on the viaduct. The greatest deflection under this load was $^1/_9$ in. In another test a moving train of 20 cars weighing 20 tons each hauled by a locomotive weighing 48 tons was suddenly stopped by emergency application of the brakes. This was done repeatedly, the wheels being skidded on some of the stops. The greatest deflections recorded were $^1/_{10}$ in. under the locomotive and $^1/_{14}$ in. under the cars. No oscillation was observed even in the curved part of the viaduct where the columns are highest.

The one of the two viaducts which was built first took about eight months. It cost about $34,500. Its loading pier, not including the tipping apparatus, cost about $12,000, making a total of $46,500.

The Ocean Carrier.

BY J. RUSSELL SMITH, PH.D.

II.

*The Epoch of the Merchant Carrier on the Sea.**

The common carrier performs the most conspicuous transportation service upon the ocean, but the private sea carrier continues to perform a surprisingly large amount of work. The wagon, the typical private land conveyance, is relegated to a purely local work, but on sea the independent vessel is yet a good ship still maintaining a position of independence, equality and rivalry in certain phases of the work.

The development of the common carrier upon the ocean giving regular service is more recent than it is upon the land. Its beginning in American foreign commerce dates practically from the close of the war of 1812. Before that date, with certain small exceptions, the unit was the single private vessel belonging to and used by a merchant or a roving captain. Since that date the independent ship has been of steadily declining importance in comparison to the line of vessels running at regular intervals and carrying for all shippers. The causes of the late continuance of the merchant epoch and the slow emergence of the common carrier may be considered under three heads: (1) The lack of facilities for carrying on commerce, (2) the character of the commerce, including the great lack of travel and exchange of mail, and (3) the disturbed, warlike and semi-piratical conditions of the times.

(1) At the beginning of the last century and during all the preceding colonial epoch, a long period was required to deliver produce in a foreign country and get the returns from its sale. There was not, as now, prompt departure and quick voyages, not to mention selling by telegraph, and if need be, paying by telegraph. It is now easy to follow prices and, if need be, to send produce to a European commission merchant and get quick returns. By the actual commercial practice of to-day the world has ceased to have dimensions, so far as they affect international sales and payments. For practical purposes the telephones bring the merchants of a great city as near to each other as though they were in one building, and the ocean cable, with its codes of pregnant words, brings the man of all cities side by side. Their knowledge of prices, their quotations and their bargains are almost as prompt as the telephone. The financial partners of the wire-flashed knowledge are the bill of exchange, and the international banking system which can transmit credits and payments to the seller as quickly as quotations can be passed to prospective purchasers. From bargaining and from payment the time element has been eliminated, and the improvement of shipping shows that in a century about three-fourths of the time element has been cut out of the actual moving of commodities.

A comparison of the modern speedy methods with the possibilities that faced the 18th century merchant shows why there was so little organization in those days. A single exchange of letters in any bargaining operation took an amount of time. If a man made a quotation by mail greater than the long round voyage, it might be three months before his transatlantic correspondent could accept or decline. Plainly, business by correspondence was well-nigh impossible—a paralyzing example of the drawbacks that came from slow communication. It is true that the bankers had long used bills of exchange in place of bullion and cash, but the bills had to be presented. In the year 1837 there were some heavy failures of American merchants in London, due to the non-arrival of large remittances which they expected to come by the New York packets. They were hourly expected, but were so greatly delayed "during the prevalence of extraordinary east winds which blew for two months"[1] that the merchants with wealth locked in the Atlantic winds failed wretchedly in London for the want of it. This, too, occurred in the days of the famous American packet ships. The present cable would have shot the wealth across the sea literally as quick as lightning. The sailing vessels of 1800 were so slow that months elapsed before American goods sent to a European merchant could be heard from.

It was therefore difficult to organize regular ocean carriers in the face of such difficulty of over-sea communication, and the natural response to the conditions of the time was that each vessel usually became a commercial unit—a trading unit—her commercial operations being managed by some one on board in much the same way that a cart peddler or a trader among the Indians seeks his market. The management of the business and the goods concerned had to be in the same place. The possibility of detached control of moving merchandise had not arisen. Under such conditions regularity of exchange of goods is difficult to arrange, and it is upon regularity that lines of vessels depend. Satisfactory development of lines demands such organization of commercial operations that the supercargo or the bargaining captain can be done away with, so that the merchants may stay at home and send their goods by the dependable carrier. This was almost impossible in the slow-going and disturbed century preceding the peace of 1815.

The continuance of the period of private ocean carrying enterprise was made easier by the small tonnage of the ordinary vessel of that day. It was by its size fitted for a private conveyance. Three or four modern freight cars would hold as much as a good-sized vessel and more than most of them. The Maryland or Virginia planter living upon the tidewater estuaries connecting with the Chesapeake often had his own sailing vessel by which he could send his tobacco or grain to Europe. If he had room he might carry some of his neighbor's. The merchants of our seaports who handled the export commodities of the small producers placed this freight in their own ships, sent it across the sea to market to be sold upon their own account, by their own representatives and loaded the ships with goods to be distributed from their own warehouses on this side. Almost the whole of ocean transportation of this period was upon the basis of the individual ship carrying the private cargo of her merchant owner.

(2) The character of the commerce was such that no steady flow of goods took place between Europe and America or any other two continents of the world. America was in the homespun stage and every household was nearly independent of every other one and of the rest of the world. Foreign trade depended largely upon luxuries and exotics. The import of manufactures from abroad was small and the family supply for many months could easily be laid in at one time. The export of our raw colonial produce was not a trade requiring shipments at all seasons of the year. It was shipped then, as are such goods now, shortly after harvest. Hence there was no great need for lines of vessels to carry freight either to or from this country at all seasons. The commerce of that day was sufficiently served by the irregular voyages of independent ships, of which there were many.

Nor were lines necessary to accommodate the travel of that period. The number of travelers was so small that it would not have paid ship owners to establish passenger lines. People did not go to sea for pleasure in those days. They went when they were compelled to, and their departure was a matter of tears, prayers and the making of wills. Those few persons who were thus compelled to make sea journeys hunted up any vessel that happened to be going their way and made their bargains with the captain.[2] The passenger was a corollary, a by-product gladly taken and even advertised for[3] when opportunity offered and the vessel came to a promising port; but the passenger traffic was never sufficient for a regular business. It is surprising to note the small provision for passengers and the consequent small passenger traffic at the time of the introduction of steam navigation on the North Atlantic. The famous packet ships of 1840 usually had provision for ten first cabin passengers and twenty second cabin passengers. In the steerage they could carry hundreds of emigrants to a new home across the Atlantic, but the emigrant business was small in the half century between the Stamp Act and the exile of Napoleon. The satisfactory unit for all kinds of ocean carrying was, therefore, primarily and naturally the freight vessel sent across the sea upon the private enterprise of her owner.

After the Revolution various changes in national life, commercial conditions and the technique of ship building were paving the way for a rapid rise of common carriers when the world settled down to order after the commercial chaos of the epoch of dynastic, colonial and imperial wars that ended in 1815.

It is not the intention of the writer to give the impression that the period prior to 1815 was one of meager commercial connections. It was, on the contrary, a period of very wide shipping connections. American ships were everywhere; our fishermen, our traders and our merchants carried the flag upon their small sailing craft to places where it has since been unseen for decades at a time, but

*The author wishes to state that in the collection of data for part of this chapter he received valuable assistance from Mr. A. R. Coleman, of Philadelphia.

[1] *Quarterly Review*, Vol. 62, p. 207.

[2] In "Views Afoot," p. 22, Bayard Taylor gives a graphic account of his journey across the Atlantic with a captain whom he had sought out. This was near the middle of the nineteenth century, in the day of the regular packets, but the packets were costly, and Taylor, to spare expense, went in the style of 1800, and hunted up a captain who was quite as willing to fill his space with human beings as with cotton if they paid as well.

[3] *New York Gazette*, September, 1736.

they were bound on individual enterprises, not as common carriers, and they went once where they might never go again.

Referring to the eastern trade of Boston and Salem, Lindsay[4] says: "In the late 18th and the early part of the 19th century the merchants of Massachusetts supplied not merely their own people with the bulk of the teas, spices, silks, sugar and coffee from the East, as well as with nankeens and other cotton clothes, but reshipped them from Boston to Hamburg and the northern ports of Europe in their own vessels." Owing to the monopoly of the British East India Company they were enabled to derive large profits from trade with British colonies from which British subjects were excluded.

In the same period Philadelphia boasted that her ships went to Calcutta, Madras and Canton and Sumatra; to Leghorn Messina, Hamburg; the ports of Spain, Portugal and France, and, as of old, greatly to the West Indies.‡

This is almost as good a list of connections as that same port can boast to-day, when it is the metropolis of a state twice as populous as the nation of 1790. Many a little port like Salem, Nantucket, Richmond, Bridgeton, N. J., which sent ships the world over a century ago, is now but the harbor of fishing boats and paddle-wheelers.

The method of carrying foreign mail during the colonial period is indicative of our transportation methods until after the war of 1812. We are told in the early history of New York that the keeper of a tavern hung up a coffee bag in his place for the receipt of letters. Before setting sail the masters of vessels called for any accumulated mail and delivered the letters through some tavern at the port of destination for a penny a piece. This method the British conquerors of New York found in vogue in 1665, and continued throughout most of the colonial period. It was only in 1816 that the mail was taken permanently by regular lines of packets.

As late as 1851 an American publicist in setting forth the reasons why the United States should have a steamship line to the Mediterranean advanced as one of his arguments the fact that it was a shame for the American people and the American nation to be any longer dependent upon the chance sailing ship for the transport of mails to that part of the world. "At the present time it (the Government at Washington) is compelled to rely even for the carrying of its despatches to naval commanders on that station and the coast of Africa upon transient vessels or the ordinary routes over the continent of Europe. We have known of a case of a vessel in the Mediterranean and others on the coast of Africa required in our home service and ordered home immediately when the despatch did not reach the commander for fourteen weeks after it was sent*—time enough for the battleship "Oregon" to sail around two continents and have a month to spare.

The same writer who in 1850 was arguing for a steam line to Italy from New York estimated that since travel to Italy had so greatly increased, there must then have been 700 Americans going to Italy each year. As mail and travel go hand in hand, it is plain to be seen why there was no regular connection or regular mail to the Mediterranean from this country even in 1850, for these conditions were like those prevailing between America and the other countries of Europe at earlier dates.

(3) The effect of unsettled conditions. The period from the Revolution to the war of 1812 was one of great commercial activity, but one ill-suited to the establishment of regular connections. The European trade reprisals which accompanied the wars, beginning with the French Revolution and extending through the Napoleonic upheaval, rendered the American ship often the prey of the naval vessels of both England and France. She suffered from the navies and the privateers of both these countries from Mediterranean pirates, and it is even asserted[2] that under the cover of the general disturbances American privateers took American vessels. Under such risks the maintenance of regular service was impossible. But the profits of the commerce of this period were so large as greatly to tempt individual enterprise, and this indeed seems to have been the period of its greatest development in ocean transportation. Lindsay in his "History of Merchant Shipping" says (Vol. 2, p. 363) of this time that American "merchants and shipowners increased in numbers to an extent out of all proportion to the general state of the population. Many persons who had realized moderate capitals from mercantile and other pursuits now became daring adventurers as carriers by sea." Plain commerce was "daring adventure."

The establishment of lines which might have come then was unquestionably delayed by the uncertainties and disturbances of the time. Periods of peace, then as during the preceding century were of short duration—too short for the growth of well-established lines, which at best are the result of years of development.

The great shipping lines of the present have nearly all had small beginnings, with slow growth at first and have attained their great size in from 30 to 60 years. Their ripening into greatness is usually the result of some one man's business genius, and his career normally reaches over several decades—sometimes half a century. Many of the great ocean lines show, by an examination of their history, that they have been started and built up by the life-work of some one man. This slow growth, too, has occurred when the merchant and the carrier have had at their command all the speedy tools of to-day—of steamships, railways, telegraphs and the security of large populations and nearly continuous naval peace. During the 18th century England, France, Spain or Holland were engaged in naval wars nearly half of the time. Two decades of continuous peace were almost if not quite, unknown, and the intervals were usually much shorter than this. And pirates almost as bad as war were ever on the sea and were never out of the merchant captain's mind.

The New York and Philadelphia journals of the first part of the 18th century contain a wonderful collection of reports of the encounters and experiences with the pirates who sailed the shores of the North Atlantic. This is the reason for the 18th century resemblance in build that existed between a merchantman and a war vessel. To make matters still worse, war in that day meant privateers who multiplied many fold the number and commercial destructiveness of navies. It is hard to draw any economic distinction between privateers and protected pirates. Both forbid line traffic. No vessel was so surely theirs as the vessel of known and regular movements.

There was thus a premium on disorganization and a premium on increased trade in the first quarter of a century of our national existence. The merchant trader loaded his vessel with a cargo and sailed away. If he escaped capture he could sell his cargo in the West Indies or Europe at rates which were extremely profitable. But he took in his own hands not only his property, but his life. Here, therefore, was the most commanding motives for the building of fast ships. If you could outsail your rivals and the pirates you got rich quickly; if they outsailed you there was a fight, and perchance your ship went off under some other captain flying a foreign flag, and you might return a man before the mast or you might end your days a slave in Barbary. The result was that the American vessel became the fastest in the world.

The trade method of the period is well established by the case of one Abraham Pesch, a prominent shipping merchant of Philadelphia. He decided to risk the danger of trading with the blacks of San Domingo, who were then in insurrection and bitter with hatred toward the whole white race. Pesch's schooner was forthwith "invitingly" laden and cruised about at a safe distance, but near enough to tempt the natives. Thomas Thuit, the single white man whom the natives had saved, that he might serve their commercial interests, communicated with the schooner, assured her of safety if she moored, unloaded and sold her cargo. "Impromptu coffee at 5 cents a pound was poured like sand into the hold of the craft until water washed her gunwales."[1] The cargo was sold at a great profit on the vessel's return. Such vessels might be owned by a merchant who would send his vessel after cargo, or they might be owned by a roving trading captain, who would get a cargo in the manner indicated above and sell it to some merchant upon his arrival in port.

The career of Stephen Girard is typical of the commercial methods of the period. He was a merchant and shipowner who sent his ships for foreign goods, and he also bought cargoes that were brought to the port by such rovers as Pesch. Girard's greatest prosperity came during the period 1793-1812. He seems to have been one of the pioneers in a quickly copied policy of sending a vessel out to make repeated exchanges of cargo before returning with the accumulated profits. "His vessel went to the West Indies, where cargo was exchanged for coffee and sugar; then proceeding to Hamburg or Amsterdam, the coffee would be sold for Spanish dollars or exchanged for cargo which would secure him at the Spice Islands, Calcutta or Canton the products of those climes."[2] We probably owe the possession of Oregon to voyages of this character by which Astor and others of New York traded for furs on the Pacific coast that they might exchange them for tea in China.

Men did not usually embark on these enterprises, more dangerous than present service in the navy or standing army for mere pay. Then, too, the owner wanted the greatest possible interest of the crew in the success of the voyage. Derby, the great merchant of Salem, gave each of his common sailors the privilege of taking 800 lbs. of freight for private trafficking and personal profit. The officers had a proportionately larger share. In 1819 an English publicist bewailed the fact that his nation must soon disappear from the China trade because there was nothing to send out but bullion and coin, while the prosperous traders of the United States had the coveted ginseng and possessed a monopoly of trading on the north Pacific coast of America, where for a few trinkets and old clothes the Indians would surrender the choicest furs to be exchanged for China cargoes on so profitable a basis that even the common seaman's share of the gain was sometimes several thousand dollars.

During the merchant carrier period of the beginning of the 19th century the captain of the ship naturally filled a much more important place than he now does. At present he is chief navigator,

[4] "History of Merchant Shipping," Vol. 3, p. 6.
‡Young's "Memorial History of Philadelphia," Vol. I. p. 409.
*De Bow's Magazine, 11:232.
[2] Lindsay's "History of Merchant Shipping," Vol. 11, p. 379.

[1] Abraham Ritter's "Philadelphia and Her Merchants," p. 21.
[2] Henry Wairey's "Girard College and Its Founder," p. 16.

subject to steamship agents, who load and unload his vessel, and to pilots who keep him in leading strings until he is safely down to sea. A hundred years ago he was usually his own pilot, and he was often, in addition, the owner or the business representative of the owner, if perchance the owner was not also on board. The captain sold and bought cargo like a merchant. If he lacked the qualities for such service the ship carried a business manager called the supercargo, a man who has now long been unnecessary because of the commission merchant, the ship broker, the freight broker, the ocean cable and the wide mercantile organization that has resulted from instantaneous communication, changes which have reduced the captain to the position of conductor on a freight train and made the supercargo, like the pirate, an ornament of history.

The close of the war of 1812 has been mentioned as the most important date marking the transition from the merchant carrier to the common carrier. It is almost needless to point out that the merchant continued a carrier after this date, and that, on the other hand, there had been many previous signs of the coming change. Some of the preliminary steps in this change are worthy of notice here. First among these signs of change is the increase in the practice of chartering ships—*i. e.*, hiring out; second, is the growth of the practice of having an agent transact the port business of the ship; third, the increase of joint ownership of shipping enterprises; fourth, attempts at founding lines.

1. The practice of chartering vessels is almost as old as history. It was practiced on the Nile in Roman times, with a good bill of lading. The Venetians carried it to a fine point to the heyday of their prosperity, but the practice did not begin to affect relations in the western world until about the close of the 18th century.

It was the most natural thing conceivable for a merchant knowing the lines of trade to find that he could use more ships than he had and hire one. That it had not come into prominence much sooner must be due to the fact that wars, disturbances and governmental restrictions in America and the greater chartered companies in Europe kept mercantile firms at a small size in colonial times. But in the prosperity that came from supplying Napoleon's armies during the last decade of the 18th century ships were chartered.[1]

Closely akin to chartering was the offer of merchants of Havre to the rover Cleveland, when he was in that port empty-handed and with full pocket from profitable sale of both ship and cargo. Several firms offered to fit up a ship for him, load it with a rich cargo and let him start out to make traffic with it.[2]

In Boston[3] two vessels were advertised in 1789 as about to sail for the isles of France and India, and "any person wishing to adventure to that part of the world may have an opportunity of sending goods on freight." The use of the word "adventure" there is also extremely suggestive of the attitude of the day toward maritime operations—you sailed over unchartered and piratic seas to unknown lands, strange peoples and markets of which you had only last year's reports. This practice of carrying for others evidently advanced rather more rapidly in Great Britain than in America, as witnessed by the following passage from the introduction to the volume published in 1807 by the Society of Shipowners of Great Britain:*

> The Society of Shipowners think it important to state that the numerous body of men whose capitals are embarked at this time in British shipping are not engaged in other mercantile pursuits, but depend wholly on the returns they expect to receive from their property so employed. This observation is considered the more necessary from recent inquiries which have been made to ascertain who the Shipowners were, they never having been before considered distinct from the Merchants, and that the property in shipping generally belonged to that very respectable and intelligent class of his Majesty's subjects.

2. *The Rise of the Agent.*—Toward the end of the 18th century there appear evidences of a change in the function of the captain. His old position is well shown by this advertisement from the New York *Gazette* of 1736:

> "For Philadelphia, the Schooner Judith and Rebecah, John Clark, Master. Well-accommodated for Passengers, will sail in about ten days. For Freight or Passage agree with said master at his house near the Custom House."

This announcement, full of the atmosphere of a village on the river's bank, was replaced in 1783 by another announcing that in addition to the captain (who might not always be available to landsmen) persons desiring freight or passage could confer either with the captain or some merchant who was an important user of the vessel[4] and was taking orders for her and for the time at least acting as the merchant captain's assistant. We have here the germ of the present institution of ship agents—a world-scattered fraternity—who now arrange such a large share of the world's ocean transportation.

An advertisement of the year 1800 (Philadelphia *General Advertiser*, April) shows that the ship's agent was fast developing:

> "SAMUEL EMERY, Ship Broker.—Buys and sells vessels, procures freight or charters, transacts all kinds of business at the custom house for entering and clearing vessels of goods, and obtaining the drawbacks of bounty, etc. Settles captains' accounts, etc., etc."

3. *Joint Enterprise.*—The close of the Revolutionary war made it possible for Americans to engage in the China tea trade—a trade requiring such a long voyage and so much capital that the individual owner was often unable to finance the venture. The first American ship that went out from New York to China was the joint enterprise of merchants in Philadelphia, New York and Boston. Joint stock companies[2] were formed to build and despatch these ships. It also became common for partnerships[3] to be formed, in which each holder had a share corresponding to the present method of divided ownership in American coasting vessels, various persons owning halves, fourths, sixteenths, thirty-seconds or sixty-fourths. The captains of these vessels usually had a small share; each sailor also often had a share, in that he was allowed a certain amount of space or a certain weight of cargo to use for any merchandise he might take for private trading on the voyage. The partnership vessel was operated as a unit—a private unit—the partnership having merely split the ownership without changing management or service. The time for lines had not yet come.

4. *Early Attempts at Lines.*—There were some early attempts at the establishments of lines, but a diligent search of the literature of the period reveals but little concerning them. There were vessels to charter, and there were roving sea captains engaged in all grades of occupations, from the "honest" buccaneer to the legitimate merchant. But none of these approach line traffic, and the very existence of most of these navigators and the accounts of their activity add weight to the belief that the scanty annals of the 18th century line traffic are scant because of the paucity of such activity. What we know of the history of the period and of the requirements of line traffic show that it was plainly impossible for any such service to have been long-lived. The following incidents appear to be natural and descriptive of the period:

Before the Revolutionary war there were five packet boats plying between New York and the port of Falmouth, England, known as the Falmouth Line.[4] They sailed occasionally during the Revolutionary war, and some of them resumed service after 1783, but the accounts of their operations are extremely meager, and a dozen chroniclers aver that the first line from America was in 1816.

The signing of the Treaty of Peace of 1783 was the signal for a pretentious French venture at opening up connections with the new republic. In November, 1783, before the evacuation of New York, the "Courier de l'Europe" arrived in port from l'Orient, France, and heralded herself as the first of a line of first-class packet ships which advertised to make monthly sailings between New York and France and to carry passengers, mail and freight.[5] But the depressed condition of American commerce seems to have been very discouraging for this new venture which did not long survive. Then came the French wars, and regular service was impossible.

Mention is made in Colonial Office Records (London), Board of Trade papers, Vol. XVI, Trade Papers, of the establishment of regular sailings of packet boats between New York and England, 1703. There are also post-office record references to the New York packet service.

An examination of the documents of Colonial History of New York shows plainly (Vol. V, p. 811) that packet service could refer to a single ship, 1726, and further accounts of the traffic show that if lines existed they must have been very nearly imaginary lines. For three years, 1715-18 (Vol. V, p. 618) the average number of ships sloops and the like from New York to Great Britain was 21, of 1,461 tons and 226 men. This entire flotilla is only one-tenth the size of some steamers now plying on that route. The correspondence of the colonial governors with the Board of Trade shows frequently that there was no regular service, and that many weeks, and even months, elapsed between opportunities to send a letter.

This rather brief statement of the conditions under which early ocean carrying existed has, it is hoped, made clear the reason for calling this long period of the American colonial epoch and the establishment of the republic the epoch of the merchant carrier. There was, practically speaking, no other carrier than the merchant carrying his own goods; other service was incidental—a by-product. The common carrier, the specialist, had to have the better conditions of the 19th century, and of all of these beneficial conditions the most important were peace and security from the ravaging hand of man. The resulting traffic transformation has been remarkable.

In the merchant carrier days of the late 18th century a small city like Salem sent ships to a wide list of countries, such as we now only find trading with a few of our ports, each of which is ten to twenty times as large as was the now decadent Salem in her prime. Her merchants sailed from place to place and traded with the merchants in the ports where they stopped. To-day the merchant ships his consignments by some line of steamers from New York, Boston, San Francisco, Philadelphia, and if need be he

[1] Lindsay's "History of Merchant Shipping," Vol. 2, p. 397.
[2] "Voyages of a Merchant Navigator," p. 17. Cleveland.
[3] "Memorial History of Boston."
*The volume is entitled "Collection of Interesting and Important Reports and papers on the Navigation and Trade of Great Britain, Ireland and the British Colonies in the West Indies and America, with Tables of Tonnage and of Exports and Imports."
[4] See New York *Royal Gazette*, 1783.

[2] Scharff and Westacott's "History of Philadelphia," Vol. 3, pp. 2210-12.
[3] "Memorial History of Boston," Vol. IV., p. 204.
[4] J. G. Wilson's "Memorial History of New York," Vol. 4, p. 534.
[5] Ibid, p. 544.

will have them transshipped at Liverpool, London, Hamburg, Antwerp or Genoa, but it goes by the lines.

We still have a long list of countries on the custom house books for ship entry and clearance, but instead of being roving merchant ships, with valuable cargoes, they are tramps carrying a full load of some bulky produce—logs for cabinet, dye or tanning stuffs, ores or copper, nickel silver, iron or manganese, flint or clay for the potter, pebbles for cement grinding, guano bones or fossils for fertilizer, coal, petroleum, lumber, sugar or wheat. Most of this is new commerce—commerce of the steam engine and steamship era, and it has arisen beside the old which yet flourished, but in a different way. The tea, silk, spices and trinkets of the 18th century now ride in state and haste in some snug, secure and peaceful steamer fully insured and following a prosaic schedule along a firm, fixed, well-lighted, safe and unromantic route. Together the merchant carrier and his counterpart in independence of the pirate, ceased to be the conspicuous figures of the sea.

(To be continued.)

Immigrant Laborers in the United States.

Italy, Austria-Hungary and the Slavic countries of eastern Europe are at present the principal sources of the unskilled labor supply of the United States. They contribute more than two-thirds of all the immigrants now entering the country, about one-fourth of the total coming from Italy. The Slavic group includes the Jews from eastern Europe, who, while not Slavs, economically and industrially represent practically the same classes. The distribution, employment and manner of living of these immigrants, with special reference to their assimilation into American industrial life, is the subject of a study by Frank J. Sheridan in Bulletin 72 of the Bureau of Labor.

Although about half of them had previously been at work as farmers or farm laborers, they do not seek a similar employment here, mainly because of the higher rates of wages in transportation, manufacturing, mining and in building, where the demand for common labor has been very great. The Italian immigrant shows a marked preference for railroad construction, tunnel building, grading, ditching, building excavation, and work in factory industries, while the Slav and the Hungarian turn to those industries where the pay is somewhat higher and the work somewhat heavier—as in blast furnaces, iron and steel works, iron-ore handling, and coal mining.

Large numbers of the immigrants seek and find work through employment agencies, but the great mass, through acting on the advice of relatives and friends, go directly to the states where wages are highest and their services are in greatest demand. In 1906, 78.82 per cent. of all immigrants and 86.55 per cent. of the Italian, Slavic and Hungarian immigrants went to seven states—New York, Pennsylvania, Illinois, New Jersey, Massachusetts, Ohio and Connecticut—the states where the demands of industry were expressed in terms of the highest wages. Objection to paying long-distance railroad fares, the great demand for labor in the north, and a seeming disinclination to work in the south, except in some cases where northern contractors are building railroads in the south, kept the majority of the Italian laborers in the north. To these reasons may be added the desire of the Italian padrone agency to keep the men where it can again distribute them to its own advantage and furnish the commissary after the temporary employments cease.

Of the 36,176 unskilled laborers distributed by New York City agencies, the average rate of wages per day for the Italians was $1.46, for the Slavs and Hungarians $1.46, and for the other nationalities $1.41. Of the Italians, one-third received less than $1.50 a day, 60 per cent. $1.50 a day, and 7 per cent. over $1.50. Of the Slavs and Hungarians, 38 per cent. received less than $1.50 a day, 41 per cent. $1.50, and 21 per cent. over $1.50. These rates are for 1905 and the first seven months of 1906. The records of a large contracting company engaged on railroad construction and employing many laborers of various nationalities as well as Italians shows that the actual cost to the company of groceries, provisions and payment for cooks, waiters, fuel, light, etc., at its boarding camps for a given period was 19 cents a meal, or $3.99 a week for each man. The men were charged $18 a month for board and lodging. The records of three railroads in New York, Pennsylvania and New Jersey for 1905 and 1905 give accurately the earnings and the total cost of living of large numbers of Italian laborers employed on these railroads and living under the usual commissary system. The average earnings per man for a representative month in 1906 for 89 gangs, numbering 1,530 men, were $37.07. The cost of all food was $5.30, and of rent of shanty and sundries $1.49, or a total of $6.79, leaving a surplus of $30.28.

The Italian laborers are said to save more money at the same wage rate than any other class of European laborers in the United States. The amount is indicated to some extent by the money orders sent from this country to Italy. The total amount of money orders sent in 1906 to all countries was $62,435,343, and of this $36,798,562, or 58.9 per cent., went to Italy and the Slavic countries. The total amount of these money orders sent to Italy was $16,239,134, while the amount sent to Austria-Hungary and Russia was $20,559,428, the number of natives of those countries in the United States being about double those from Italy. These sums, great as they are, represent but a part of the total savings of these laborers sent abroad. Large amounts, of which there are no records, are sent over through Italian bankers. Immense sums in the aggregate are carried over in person by immigrants who return to Italy late in the fall of each year. At least 100,000 Italians return to Italy each year for the winter months because they find it cheaper, healthier, and more satisfactory to return to Italy and spend the winter months with their families.

Alternating Current Automatic Block Signals on the Highland Division of the New York, New Haven & Hartford.

Signal engineers who have been perplexed to decide the question whether semaphore arms should be inclined upward or downward, and whether they should project from the right or from the left of the post, may find all their difficulties settled in an actual installation which has lately been finished on the Highland division of the New York, New Haven & Hartford, near Hartford. Here the arms point both ways at once and all theories ought to be satisfied. These block signals have been installed on this section, which is eight miles long, East Hartford to Vernon, because of the introduction of electric propulsion and of a consequent large increase in the number of daily trains. The two main tracks of the steam railroad have been equipped for the use of the cars of the Connecticut Company, running between Hartford and Rockville. The signal installation is A. C. stepping down from a 10,000-volt power transmission line to a 2,200-volt transmission line for signal purposes. The signals are operated (and also lighted) directly by a 110-volt 60-cycle alternating current, so that no batterymen or lampmen are required.

Signal arms similar to those here used, pivoted near the center, have been in use for several months on the electrified section of the New Haven road, west of Stamford, where all the signals are suspended from the under side of the bridges which support the power lines for conveying current to the motors. Those here used (Fig. 1) are of the same design, except as to minor details of the casting. In the horizontal position these arms extend equal distances to the right and to the left of the bearing, but when in the proceed position much more than half of the arm is at the left of the post.

This section of the line is now used both by the New Haven road for passenger and freight service, using steam locomotives, and by the Connecticut Company, for passenger service, using electrically propelled cars. The Signal Engineer was required not only to install a signal system to work with the present direct-current, 550-volt equipment of the street railway company, but also to provide for working equally well, and without any change, with an alternating single-phase propulsion current of 25-cycle frequency, in case that should be adopted.

At each of the junctions, East Hartford and Vernon, there has been installed a manual interlocking station for the operation of the switches and signals, and the automatic semaphore signals between the stations named are set at intervals of from 3,700 to 5,200 feet. The entire electrical equipment is operated by alternating current.

Source of Energy.—Through the entire length of the signaled section there is a 10,000-volt, three-phase, 60-cycle commercial line giving a reliable 24-hour service. From this supply current is procured for the signal system, the connection being made through step-down transformers. The transformers are connected to one phase of the high potential line, stepping the current down from 10,000-volt to 2,200-volt and connecting through oil switches to the signal transmission lines which extend the entire length of the signal system. From this 2,200-volt, 60-cycle line, current is obtained through transformers for the various signal requirements.

Interlocking Plants.—The interlocking towers are built on concrete foundations. In the front opening in the foundation for the lead-out the building is supported by cast-iron pillars set 24 in. apart between centers. In these cabins special attention was given to the design of the roof and the windows. The roof is carried out four feet from the side of the building to shade the windows, and it is slightly curved upward so that the lower edge does not reach below the top of the window and there is no limitation of the signalman's outlook. The lower window sash is much longer than the upper so that the frame at its upper end is above the range of the eye, and the building is so framed that the sash when raised passes up to the plate, bringing its lower edge up to the top sash.

The machine is a Saxby & Farmer and the frame rests on concrete foundations. All home and dwarf signals are pipe connected and stand upon concrete foundations. All cranks and compensators are mounted on iron piers imbedded in concrete. The distant signals are of the electric motor type the same as the auto-

matic signals hereinafter described. These signals are controlled from the tower and also through circuit controllers attached to the arms of the home signal to which they govern the approach. All home signals are equipped with electric slots, which are controlled by an indicator in the tower, the indicators being controlled by the track circuit, so that the operator has constantly before him an indicator which shows the presence of any train on any section of track to which his signals give admission. All levers which operate home signals controlling distant signals are equipped with an indication lock which prevents the latching of the home signal lever in the stop position until the distant signal is in the caution position. The electric slots, indicators and locks are supplied with current by a duplicate set of 24-ampere-hour storage batteries. The batteries are charged by a single-phase mercury-arc rectifier, taking current from the 2,200-volt signal transmission line through a transformer stepping down to 110 volts.

Automatic Signals.—The automatic equipment consists of home and distant signals mounted upon the same post. The eastbound and the westbound signals are placed nearly opposite each other but are staggered sufficiently to avoid putting a signal where a trolley pole will hide it from the engineman. The blade grip castings are designed to permit the arm to extend to the left of the post for the reason that the trolley poles would obstruct the view of the signal if it extended only to the right.

The motor signals have double-case bases and rest on concrete

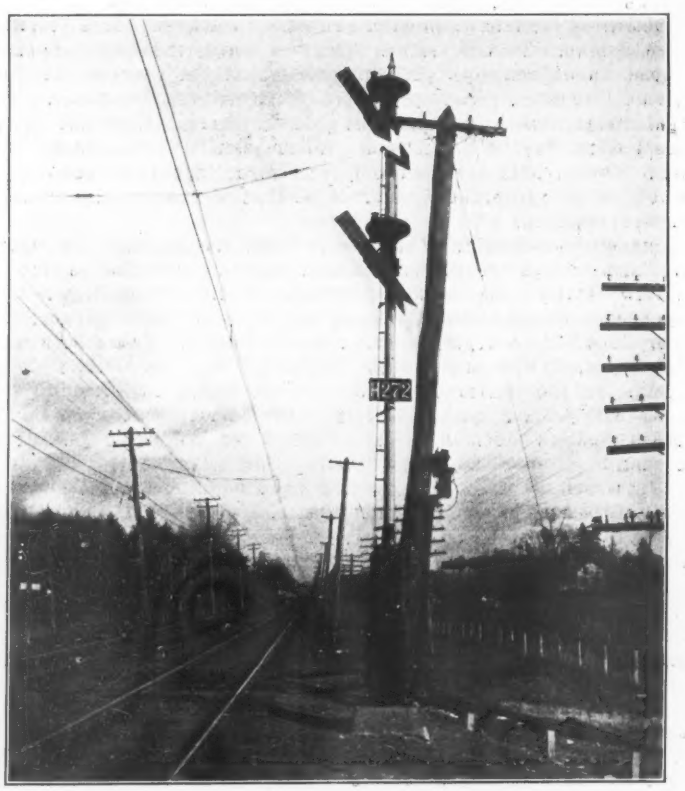


Fig. 1—Special Semaphore for East Hartford-Vernon Line.

foundations. The upper case contains the signal mechanism which is operated by a 110-volt single-phase induction motor. The motor has sufficient torque at starting to start under load from any point in the arc through which the signal travels. The time required to clear both the home and the distant arms is five seconds. The lower case contains the track relays, the line relays, the controlling switches, the fuses and the lightning arresters. All signals have the same apparatus in the same relative position and are wired alike, so that the maintainer finds a uniform arrangement in all the cases. Duplicate two-candle power incandescent electric lights are used in the lanterns. Oil founts are also provided.

At each signal there is a transformer transforming the current from the 2,200-volt line to 110 volts to supply current for the local signals and the control circuits for the next signals in the rear. All wire connections between transformers, signals, tracks and the signal control circuits are in wood boxing placed upon stakes four feet apart. The signal control line extends the entire length of the block section, taking energy at the outgoing end and looping through the track relays and switch instruments.

The track circuit equipment installed is designed to be used with a propulsion current either direct or alternating; either 550-volt direct or 11,000-volt 25-cycle single-phase alternating. The electric railway company required that the tracks be cross bonded at least every 3,000 ft., thus making necessary a "cut section" in each block. Energy is supplied to the tracks by a transformer situated in the middle of a track circuit section. The track circuit has a relay at each end. These are "frequency" relays, that is to say,

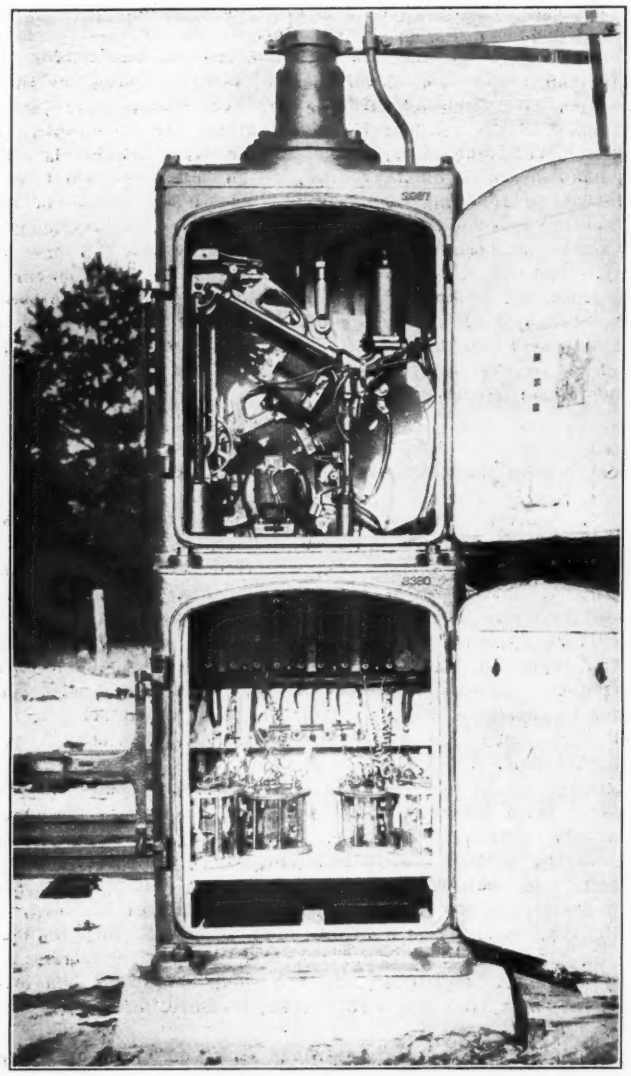


Fig. 2—Signal Motor and Relays.

relays which respond only to alternating currents of a given frequency. These control the signal circuits. At each end of the track circuit there is also an inductance bond the terminals of which are connected to the rails and the center of which is connected to the center of the bond of the next track circuit, thus forming a metallic connection around the insulated rail joints for the return propulsion current. This center connection may also be used for cross bond taps.

The inductance bonds were designed to carry the heavy current necessary with direct-current propulsion and also were perfectly balanced to offer the least possible impedance to an alternating propulsion current. In fact, if the external track return is perfectly balanced the only impedance of the bonds may be said to be ohmic. The frequency relays are absolutely immune

Fig. 3—Signal Cabin, Vernon, Conn.

to a direct current or to alternating current of 25 cycles, having been designed to operate at 60 cycles. The unbalancing of the track therefore, even if sufficient to throw a heavy current through the frequency relays, would not result in a false clear signal indication. This system will, of course, be not in the least affected by any foreign trolley current. In connecting the inductance bonds to the rails use is made of an old rail about 15 ft. long. To connect up an inductance bond to a track with broken or staggered joints, it is necessary either to cut one rail of the track so as to have the

In Fig. 1 the 2,200-volt signal wire may be seen on the pole which stands close to the signal. The 110-volt signal wires are on the lower arm of the Western Union poles, situated at the extreme right of the photograph. The three-phase, 10,000-volt, 60-cycle, and the three-phase, 11,000-volt, 25-cycle power lines are on the upper arms of the poles at the left of the track, while the short lower arm on these poles carries the 550-volt feeders for the trolley wires. Fig. 2 shows the motor signal case with the relays in the lower part. Fig. 3 shows one of the standard interlocking cabins.

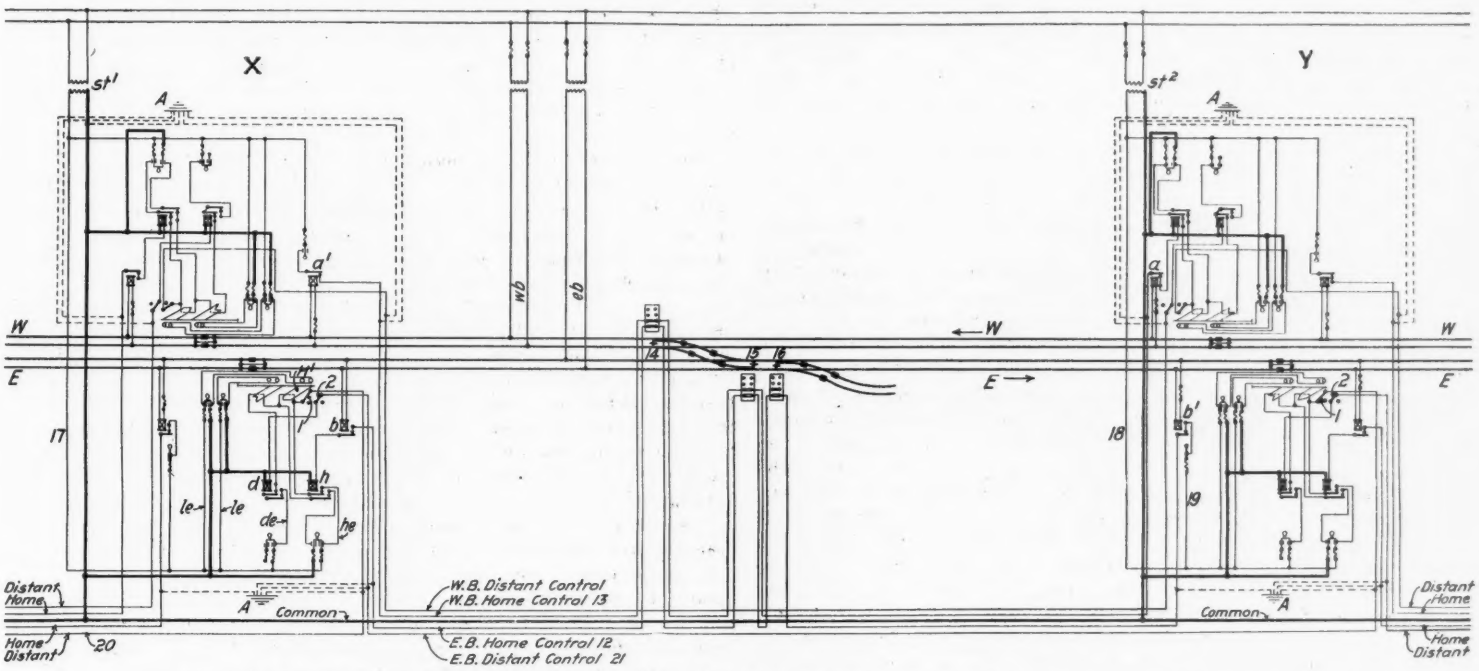


Fig. 4—Signal Circuits for Electrified Line; Highland Division, New York, New Haven & Hartford.

insulated joint near the bond, or to provide a conductor from the bond to connect with the track beyond the insulated joint, which may be some 15 ft. The piece of steel rail is better than copper because it costs less and is not liable to be stolen; and besides this if alternating current is used for propulsion, the iron serves to restore the balance of the inductance of the two lines of rails, which with one side 15 ft. shorter than the other, would be unbalanced.

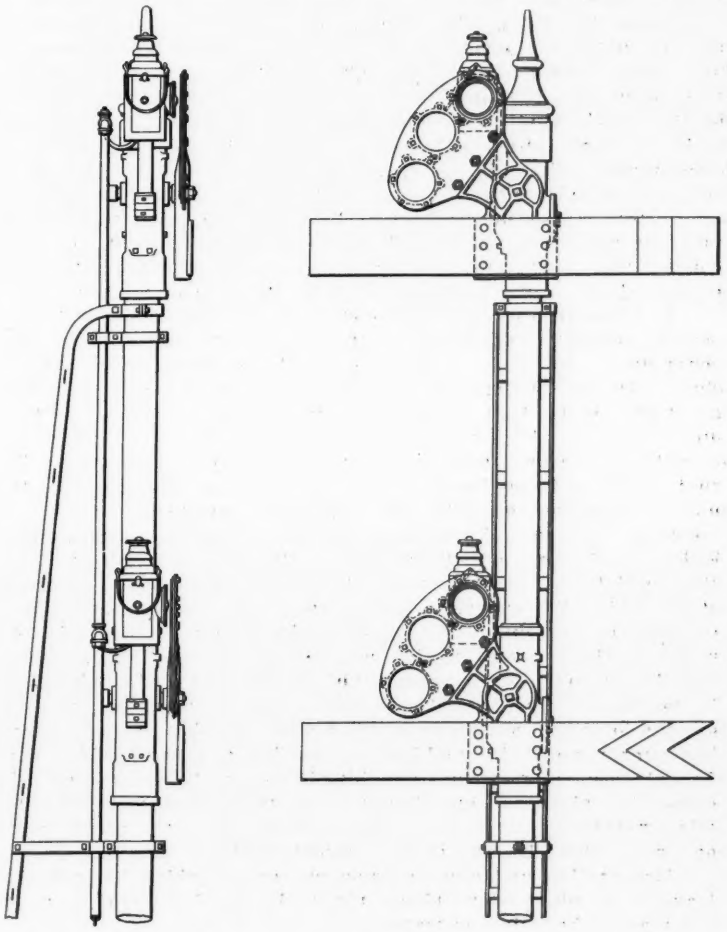


Fig. 5—Details of Signal, Showing Electric Light Connection.

The arrangement of the track and signal circuits is shown in Fig. 4, in which W is the westbound and E the eastbound track. Taking, for example, the eastbound track, the current is fed to the rails at *e b* near the middle of the section, and this circuit controls the signals through relays *b* and b^1. These two track relays, when closed, close signal relay *h*, at station X, which receives energy through home control wire 12 from transformer *s t 2* at station Y, through wires 18 and 19. Signal relay *h* closes the motor circuit to home signal H^1, admitting trains to block section X Y. Power for this motor comes from transformer *s t 1* at station X through wires 17, *h*, *e*, etc.

Home signal H being cleared, is clears the corresponding distant signal in the rear by means of the circuit closer 1, and distant

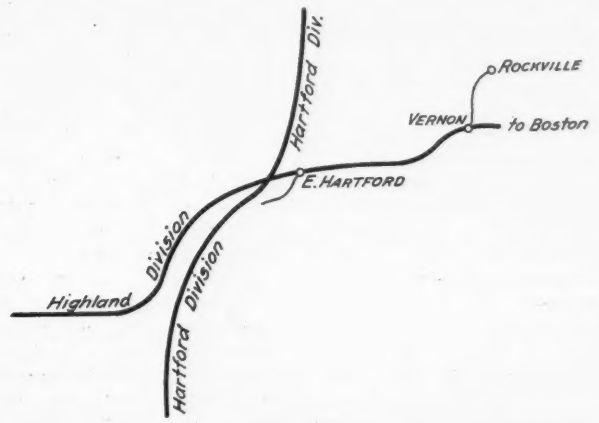


Fig. 6—Electrified Line—East Hartford to Vernon.

control wire 20. The distant signal at station X is controlled in the same way through relay *d*, which receives energy through circuit breaker 2 on signal H^1 and distant control wire 21, which may be traced to circuit breaker 2 at station Y. Signal H^1, when put to the stop position, causes the distant signal on the same post to also go to the horizontal position by opening circuit breaker 2.

The control wires not numbered are for the westbound track. The common wire is shown by a heavy line throughout the drawing.

The control wires are run through the switch instruments in the usual manner, and opening either switch 14 or switch 15 puts in the stop position the signals on both main tracks. The locations of the lightning arresters at each signal are shown by broken-line connections to the ground, *A*.

The arrangement of the electric lights on the signals is self-

explanatory. These lights derive their power from the mains, as may be seen by following wires 17, *l. e* at station X.

The apparatus for the entire installation was designed and installed by the Union Switch & Signal Company of Swissvale, Pa.

The Best Design of Car for Suburban Traffic at Melbourne.*

BY THOMAS TAIT,
Chairman of the Victorian Railways Commission.

The type of car best suited for the passenger traffic on the Melbourne suburban lines is a subject which has been receiving the consideration of the Commissioners for some time past, and I lost no opportunity of acquiring information which would be of help in determining this important question, visiting Hamburg and Chicago mainly for that purpose.

The latest standard car in use on the Melbourne lines for suburban traffic is of the cross compartment type, with two side doors for each compartment, and no corridor. The body of this car is 50 ft. long, and 8 ft. 6 in. wide, and will seat about 80 passengers. The principal advantages of such a car are maximum seating capacity for its length and width, as no space is taken up for corridors, and the celerity with which passengers can enter and leave the car owing to there being side doors for each compartment.

One of the disadvantages of such a car is that there is no means of getting from one compartment to another, which results frequently in some overcrowding with passengers standing in some compartments, while, at the same time, there is seating accommodation to spare in other compartments on the same train. Passengers from a way station boarding a fairly well filled train (that is, a train in which a number of the compartments are already fully occupied), have not much time to select a compartment in which there is unoccupied seating accommodation, and are apt to enter compartments which are already fully occupied, in which event, owing to the absence of any means of access to other parts of the car or train, such passengers must either stand or overcrowd the seating capacity of such compartments, and this, although there may be seating accommodation to spare elsewhere on the train. The provision of corridors in the cars and of vestibule connections between the cars would overcome this and permit of a better distribution of passengers throughout the trains, and the use of the seating accommodation to the fullest extent. Investigation of some of the complaints received as to overcrowding on our suburban trains shows that while some of the compartments had more passengers in them than there were seats, there was seating accommodation on the train as a whole for all the passengers on it.

Another disadvantage of the existing type of car is the swinging side door.

Although the gage of the Victorian lines is 5 ft. 3 in. (with the exception of three short narrow-gage lines), we do not derive as great an advantage as we should from this wide gage in the direction of being able to run wide carriages, etc., as contrasted with a 4-ft. 8½-in. gage, owing to the fact that the tracks on double-track lines and elsewhere have been built so close together, viz., 11 ft. 8 in. center to center, whereas in America the 4-ft. 8½-in. double tracks are built from 12 ft. to 13 ft. center to center.

It has not been considered advisable to use so wide a side-door car that the side door, if open, would strike the head or arm of a person projecting from a car on a contiguous track, and this has limited the width of the body of the cars for use on our suburban lines to 8 ft. 6 in. The use of sliding, instead of swinging side-doors would, I think, permit of the width of these cars being increased to about 9 ft. 6 in., with a considerable increase in the floor area available for seating accommodation and corridors.

Another disadvantage of the swinging side-door is the fact that it requires—in the interest of the safety of the passengers in the compartment, as well as those on trains running on contiguous tracks and of persons standing on station platforms—to be closed and fastened, and that this requires the services of the guards and platform staff, as well as involves some delay at stations, and the closing of these doors is accompanied by objectionable noise, which cannot be entirely avoided. Moreover, a swinging side-door closed but not fastened is an element of danger, especially in the case of children riding in the compartment, as it may swing open if leaned against.

The closing and fastening of side-doors will become a very important matter if electric traction is adopted, for with the increase in acceleration on electric trains (that is, the increase in speed when starting from stations) it will not be possible for the present staff to close and fasten such doors, and to restrict the acceleration on electric trains would be to abandon to some extent one of the chief advantages of electrification.

The adoption of a sliding side-door on the cars employed, at least for the suburban traffic, would enable us to safely widen those cars sufficiently to provide a corridor without diminishing their seating capacity, thus with vestibule connections, between the cars, enabling the passengers to distribute themselves throughout the train, and utilize the seating accommodation to its fullest extent.

Sliding side-doors could not, however, be closed and fastened by the guards and platform staff, but I see no reason why such doors could not only be opened, as the swinging doors are at present, by the passengers themselves, but the closing and fastening of them be left, with safety, to the passengers, as in the case of the electric cars on the Southport line of the Lancashire & Yorkshire. Thus, not only would some time at stations and labor of staff be saved, but the noise accompanying the closing of swinging doors be got rid of. Less danger would be attached to failure to fasten a sliding door than in the case of a swinging door, for, in the event of a child or other person leaning against it, it would not swing outwards and would not slide. The liability to catch and seriously injure fingers would be less with the sliding than the swinging doors, as also the liability to injure persons standing on station platforms. I may add that sliding doors at the ends and the center of cars have been lately adopted on the underground railways in London, and opposite each pair of seats on the Illinois Central for its suburban traffic at Chicago.

As I have mentioned, the adoption of sliding doors would enable us to safely use wider suburban cars and provide a corridor without much, if any, reduction in the seating capacity. On the underground railways in London the cars with sliding doors have a central corridor, or, more properly speaking, a central aisle, while in the Illinois Central company's new type of suburban car there is an aisle on each side. This latter is, no doubt, the best arrangement to facilitate the movement and distribution of passengers throughout the car and the celerity of ingress and egress, but two aisles occupy too much space, and the advantages gained as contrasted with one aisle do not justify the sacrifice of so much seating accommodation. The extra space gained by the use of sliding instead of swinging doors for suburban cars will not be sufficient to provide more than one aisle without a serious diminution in seating capacity, which we cannot afford, but a corridor or an aisle along one side only would appear to have an advantage over a center aisle in that passengers entering the car on the aisle side could, in the event of there being no vacant seat in the compartment immediately opposite the door by which they entered, pass along the side aisle to a compartment with vacant seating accommodation without in any way disturbing the passengers in the compartment immediately opposite the door by which they entered the car as they would with a center aisle.

It would be possible, as a rule, to so run cars with one side aisle that the aisle would be next the station platforms on the trains bringing passengers into the city, especially during the busy hours of the morning, the seating capacity of which trains is fully taxed, and for which passengers have little time to select a compartment with vacant seating room. The aisle being on the side of the car away from the platform at the central terminal stations on departing trains would be no disadvantage, as passengers taking such trains at those stations have, as a rule, ample time to select a compartment which is not fully occupied. Nor would the aisle being on the side away from the platform be of any disadvantage in the case of passengers disembarking at any station, as it would not be necessary for them to use the aisle to reach the door of their compartment. The Prussian State Railways have adopted an aisle on one side for their suburban cars in Berlin and Hamburg.

The accommodation for passengers in a number of our suburban cars is somewhat too luxurious and too liberal as to space, and consequently too costly, having regard to the comparatively short time suburban passengers occupy such accommodation. The average length of all journeys on our suburban trains during the year ended June 30, 1907, was only 4.76 miles, and the average time occupied per journey about 17 minutes—the average fare being 4.82 cents,* which is equivalent to 1 cent* per passenger mile. Not only do partitions and high seat backs and luxuriously leather upholstered seats and backs with upholstered arm-rests add appreciably to the cost of suburban cars, but they add materially to their weight—a very important factor in view of the numerous starts which the suburban trains make, and the heavy gradients on some of our lines. We can undoubtedly save considerable expenditure in the construction and maintenance of our suburban cars by the adoption of comfortable low-backed seats upholstered in leather or other suitable material without arm-rests, and the elimination of all partitions except between smoking and non-smoking compartments, in combination smoking and non-smoking cars. The abolition of partitions and high-backed seats will not only increase the air space and improve the ventilation and light, but allow passengers to see at a glance where there are vacant seats, and reach them by way of the proposed aisle.

The seating and other accommodations provided for suburban travelers at the various places visited by me fully confirm me in the views I have just expressed.

*This statement is from the report of Mr. Tait on electrification of steam railroads, most of which was published in the *Railroad Gazette* of Dec. 13, 1907, on page 709.

*Pence transferred to cents by multiplying by 2.

GENERAL NEWS SECTION

NOTES.

The New York, New Haven & Hartford has established a school of telegraphy at Boston.

The Swiss Federal Railroads have opened a handsome passenger office in New York City, at 241 Fifth avenue.

The amount of anthracite coal mined in the year 1907 was 67,109,393 tons, by far the largest production on record, and about 11½ millions more than in 1906.

The State Railroad Commission of Georgia is to issue an order revising passenger rates in the state in accordance with the proposition lately made by the Southern Railway.

The legal department of the state of Wisconsin is to sue the Chicago, Milwaukee & St. Paul for violation of the law limiting to eight hours the working time of certain employees.

President Finley announces that, in view of the falling off in business, the Southern Railway has determined to reduce by 10 per cent. the pay of the President, Vice-Presidents and the other general officers, and their office forces.

The Chicago subway now moves 2,000 cars daily, of which 1,200 carry United States mails. The lines now connect with 11 railroads and 14 large mercantile houses. Negotiations are under way for many other connections.

The Attorney-General of Texas has filed suit against the Missouri, Kansas & Texas, the Texas & New Orleans and the Galveston, Harrisburg & San Antonio for heavy penalties for alleged violations of orders of the Railroad Commission, requiring them to run their passenger trains on time.

Under a decision by a board of arbitration telegraph operators on the Grand Trunk are to receive an increase of salary of about 10 per cent. and aggregating $27,000 yearly. This refers to ordinary operators; about $10,000 will also be added to the pay of telegraphers in the higher grades.

Senator Crane of Massachusetts has introduced in Congress a resolution instructing the Interstate Commerce Commission to enlarge the field of its investigation of safety appliances by including facing point switches, the necessity for protecting them, and also the question of the automatic control of such switches.

The Department of Justice at Washington announces that the Chicago, Burlington & Quincy and the Chicago & Eastern Illinois are to be at once prosecuted on indictments for giving secret rates similar to those on which the Chicago & Alton was tried (but let off) and on which the Standard Oil Company was fined $29,400,000.

The Georgia State Railroad Commission has issued a rule requiring railroads to receive and check baggage for prospective passengers, in advance of the passenger's departure. The checks given may be made exchangeable for a regular check at the time of departure, and if baggage is brought more than 12 hours in advance a storage charge may be imposed.

The Long Island Railroad advises that there has been no thought of abolishing demurrage charges at Long Island City or other stations. The note in our issue of January 10 proves to have been based on a proposition to discontinue track storage charges, which, however, has not yet been carried out. It appears that on certain team tracks special "track charges" are made.

At Mineola, N. Y., January 8, a conductor on an electric railroad was sentenced to three months' imprisonment for manslaughter in the second degree. He was held responsible for leaving a meeting point before the opposite car had arrived, his action being in direct disobedience of an order. In the resulting collision the motorman of the other car was killed. The case has been appealed to a higher court.

A number of roads have reduced wages in freight houses and in forces of laborers, on track work and elsewhere; and reductions still more expensive appear to have been decided on in many cases, but not formally announced. Reductions of working hours in shops and on track work are numerous. On many roads payrolls have been much reduced within the past two weeks, without changes in rates, by the falling off in freight traffic, trainmen being paid by the trip.

The Farmers' Special, which was run by the Cincinnati, Hamilton & Dayton the first week in January, and heretofore referred to, stopped at 26 places and over 6,000 farmers were addressed by the speakers. Division Freight Agent Law says that the enterprise was a great success, outdoor meetings having to be held to accommodate the large numbers attending. State Grain Inspector Culver accompanied the party and gave useful statistics concerning the profits which have been made on different kinds of grain.

The Interstate Commerce Commission has issued a circular calling the attention of railroads to the necessity of changes in many features of many freight tariffs to make them conform to the law and to the rules which have been promulgated by the Commission, and stating that all tariffs hereafter issued must conform strictly to the regulations. Tariffs now in use, however, may be continued in force until July 15, 1908, notwithstanding their irregularities, provided the railroads show good faith in their endeavors to eliminate all features which are not approved by the Commission.

Prosecutions for Imperfect Car Couplers, Etc.

The Government is going to prosecute the Illinois Central in Kentucky for 22 violations of the Safety Appliance Act. A prior decision in that district on similar cases was unsatisfactory, but the circumstances were such that the United States could not take an appeal. The suits now about to be brought will be so framed as to cure this difficulty.

Attorney-General Bonaparte last week directed the various United States Attorneys to institute suits against 43 other roads, 342 violations in all. The roads are:

	No. of violations.
Ashland Coal & Iron Rwy. Co.	28
Atchison, Topeka & Santa Fe	11
Baltimore & Ohio	28
Baltimore & Ohio Southwestern	1
Boston & Albany	12
Boston & Maine	5
Butte, Anaconda & Pacific	1
Butte County	11
Central of New Jersey	15
Chesapeake & Ohio	25
Chicago, Burlington & Quincy	5
Cincinnati, New Orleans & Texas Pacific	8
Delaware & Hudson	9
Denver & Rio Grande	8
El Paso & Southwestern	7
Erie	4
Great Northern	2
Gulf, Colorado & Santa Fe	6
Idaho Northern	2
Kansas City Southern	1
Louisville & Nashville	3
Missouri, Kansas & Texas	1
New Orleans & Northeastern	1
New York Central & Hudson River	4
New York, New Haven & Hartford	10
New York, Philadelphia & Norfolk	2
Northern Pacific	36
Oregon R. R. & Navigation Co.	1
Oregon Short Line	9
Pennsylvania	6
Peoria & Eastern	2
Philadelphia & Reading	1
Pittsburgh & Lake Erie	6
St. Louis, Iron Mountain & Southern	3
St. Louis Southwestern	1
St. Louis Southwestern of Texas	5
St. Louis, Watkins & Gulf	11
Salt Lake & Ogden	1
Southern	8
Southern Pacific	10
Tombigbee Valley	5
Union Freight	3
Wheeling & Lake Erie	24

Helping to Restore Confidence.

The Sherwin-Williams Co., Cleveland, Ohio, is trying to help re-establish normal business conditions by increasing the enthusiasm of the members of its force. The following extract from a bulletin issued by General Manager W. H. Cothingham to representatives of the company is a good example of the encouraging literature it is distributing.

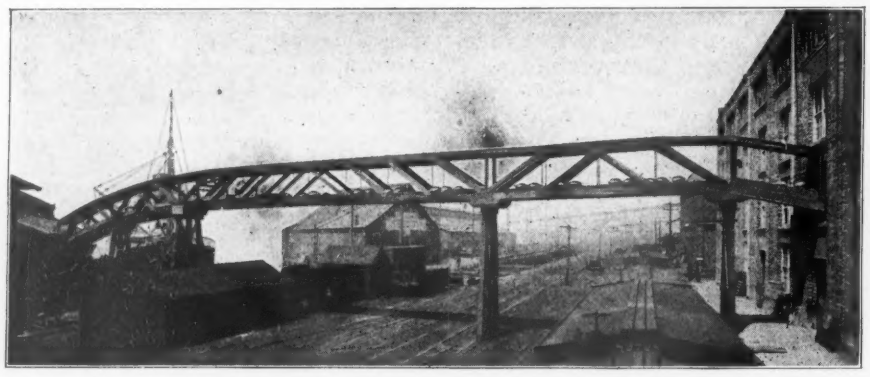
"America is a great and an extraordinary country. Whatever she does, she does in a big way. No other country has ever done as many big and extraordinary things as she has. When she goes in for a panic it's a good one; not a little flurry, not a little storm, but a good, stiff hurricane; one worthy of her vastness and her gigantic force. Big storms, while extremely severe at the time, don't last long. They usually leave some wreckage behind, it's true, but the worst is soon over. The clouds quickly pass and the sun shines for all once more, and we feel better for it and appreciate more fully the daily blessings we enjoy. The great financial hurricane that has swept across the land is over. It will take a little time to clear away the debris, but not long, for the wreckage has not been great, and the warm sun of prosperity will soon repair what damage has been done. Let me repeat, America is a great country, and always does big and extraordinary things—this is the proof of her genius; and, just as the panic stunned us all with its fearful suddenness and frightful severity, I believe, now that it has passed, we will have an exhibition of the country's great stability

and recuperative powers that will astonish the world as much as the panic did."

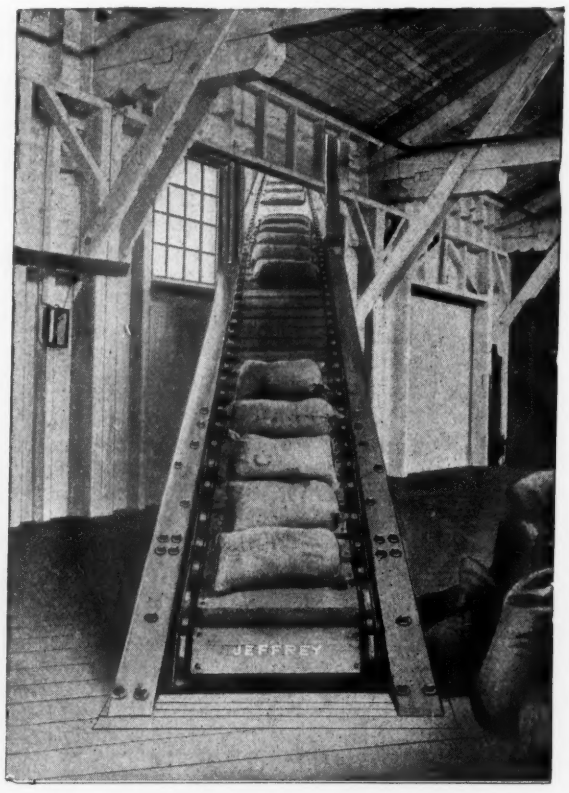
Overhead Carrier Between Warehouse and Dock.

All steamboat cargoes discharged or awaiting shipment at the Virginia street dock in Seattle, Wash., are stored in a warehouse on the opposite side of Railway avenue, about 250 ft. from the dock. A large volume of miscellaneous freight is handled daily between the dock and warehouse. To transfer this economically and at the necessary speed, without obstructing traffic in the street, there was recently installed an overhead carrier which does the work at low cost and which can handle the freight more rapidly than it is possible to load or dispose of it at the terminal points. The equipment is simple and can be modified to suit almost any industrial condition which involves moving packages or miscellaneous articles in large numbers between fixed points.

As shown by the accompanying illustrations, the dock and warehouse are connected by a light elevated structure which supports an endless-chain carrier, with terminals on the dock level at one end and on the second floor of the warehouse at the other. The carrier consists of a series of wooden flights, 9 in. wide by 4 in. thick and 30 in. long, made of Puget Sound fir. These are secured every 12 in. to two strands of No. 180 Jeffrey steel-thimble roller chain, forming an almost continuous apron on which the freight



Overhead Carrier Between Warehouse and Dock.



Dock End of Overhead Carrier.

is carried. Wedge-shaped blocks attached to every third flight catch anything that might roll down the incline at the dock end. The conveyor is driven by a 10-h.p. electric motor at the upper, or warehouse, end.

Being reversible, it carries freight to equal advantage in either direction. It is designed to handle packages not more than 3 ft. wide and 4 ft. high. They are usually cases of salmon, sacks of salt and sugar, barrels of cement and miscellaneous articles weighing as much as 1,000 lbs. each. It travels at a speed of 70 f.p.m. and consumes about 6 h.p. when delivering 1,000 packages weighing 100 lbs. each per hour. As already mentioned, this rate of delivery represents the limit of speed with which packages can be loaded and cared for at the dock and the warehouse; it is much below the actual capacity of the machine.

The plant was designed and installed by the Pacific Engineering Co., Seattle, the conveying machinery being furnished by the Jeffrey Manufacturing Co., Columbus, Ohio. The latter company has installed several machines of this general character for handling freight to and from ships direct; for such work the outer end is adjusted to the rise and fall of the tide and the height of freeboard of vessels.

Storage Battery Motor Truck for Industrial Railways.

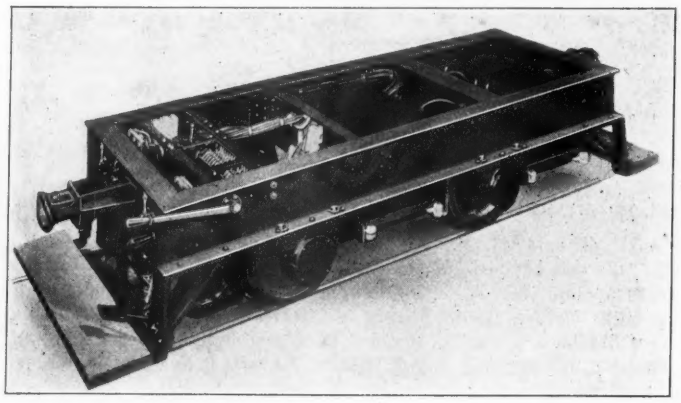
The Westinghouse Machine Co., Pittsburgh, Pa., is now making and selling storage battery motor-trucks of from 10 to 40 tons capacity for use on industrial railways. The company used to use at its own works small cast-iron 3-ft. gage trucks, of small capacity and moved by hand. Heavy castings were carried on 50-ton trucks, which were usually moved by a rope passing under a snatch block and attached to a crane hook. When the storage battery trucks were installed there was a marked improvement in crane service, since they relieved the crane of the work of transporting many of the heavier castings from one end of the long shops to the other.

The accompanying photograph shows a 10-ton truck. A steel frame, thoroughly braced, is carried on four wheels, the journals of which run in roller bearings. The driving axle or axles, as the case may be, carry the motor, or motors, as in street railway practice. The motor is spring suspended from the frame at one end, and connected to driving axle by suitable reducing gearing. A spring suspended cradle of angle irons carries the battery trays. At the operating end of the truck are mounted the controller, brake, charging receptacle, cut-out switch and volt-ammeter. A convenient step and drawbar head are provided at each end. All the machinery is below the top of the frame and is covered by a heavy wooden deck for carrying the load. This deck, which is not shown in the illustration, is made in sections, so that any part of the mechanism is readily accessible.

The motor is of the Westinghouse vehicle type, designed for heavy overloads, and being dustproof and self-oiling. The controller is of the same type, and gives four speeds in either direction. It is provided with operating and reverse levers, which are interlocking to prevent premature reversal.

The battery is in two or more trays of cells and is built to operate at high rates of charge and discharge, so as to stand short periods of heavy duty usually requiring a battery of four or five times the capacity. Another reason for adopting a battery of smaller ampere hour capacity than is customary in similar work is that the time available for charging during the working hours is usually three times the period of time that the truck is actually running.

During a six months' test of the 10-ton truck, the power required to charge the battery in regular and heavy shop service averaged 63 k.w. hours a month. The work done was recorded and averaged about 700 ton miles a month, the loads ranging from a few hundred pounds to 15 tons. These trucks used as locomotives on a level track and without any weight to secure adhesion can haul, on suitable cars, from one-half to their full rated capacity as a truck, depending on the condition of the track and kind of bearings on the cars hauled. By placing sufficient weight over the drivers to secure adhesion, they can handle from one to two times their capacity as a truck for a continuous period of not more than five minutes.



Westinghouse 10-Ton Storage Battery Motor Truck.

Standard trucks are made for six different gages: 18, 21½, 24, 30 and 36 in., and 4 ft. 8½ in. For track systems provided with

turn-tables they are made with rigid trucks. Where tracks are installed with curves, the trucks for all gages, up to 36 in., have swivelled front axles, allowing free operation on curves of 12 ft. radius.

Long-Time Burner Without a Chimney.

Peter Gray & Sons, 82 Union street, Boston, Mass., makers of switch and signal lamps and lanterns, use a chimney-less long-time burner for such lamps. They report the results of a long-time service test as giving a high candle power after burning 100 hours. The

Fig. 1—Chimney-less Long-Time Burner.

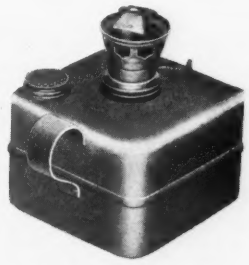


Fig. 3—Oil Fount.

Fig. 2—Peter Gray & Sons' Semaphore Lamp.

shape and style of the burner are shown in the accompanying engravings. By doing without the chimney it is expected to save about one-half the cost of this part of the lamp, besides doing away with the risk of failures of lights from accumulations of smoke on chimneys and from breakages. Because of the peculiar design of the burner, the flame issues in a wide and uniform body. It is a robust and steady flame. Messrs. Gray & Sons have also designed a new fount, as shown in the engraving, Fig. 3. Both fount and burner are so designed that the position of the flame in relation to the lens is the same as in former styles.

Machinery Club of New York.

The Machinery Club of the City of New York is being organized to provide a convenient meeting place for persons interested in the machinery and metal trades. It is to be, primarily, a lunch club. The rooms are to be on the 21st, 20th and possibly the 19th floors of the Fulton Terminal building, which is under construction by the Hudson & Manhattan as the Manhattan terminal of its tunnels under the Hudson river. The club's quarters include a roof garden, lunch and grill rooms, assembly rooms, library and perhaps a few bedrooms for out-of-town members. It expects to occupy this space by May 1, 1908. The membership is limited as follows: Resident, 750; suburban, 500; non-resident, 1,000. The temporary address is 26 Cortlandt street. The officers are: President, F. H. Stillman, President of the Watson-Stillman Co., New York; Vice-President, R. C. McKinney, President of the Niles-Bement-Pond Co., New York; Treasurer, Walter L. Pierce, Secretary of the Lidgerwood Manufacturing Co., New York; Secretary, Theodore Waters.

Meeting of the Society for Promoting Industrial Education.

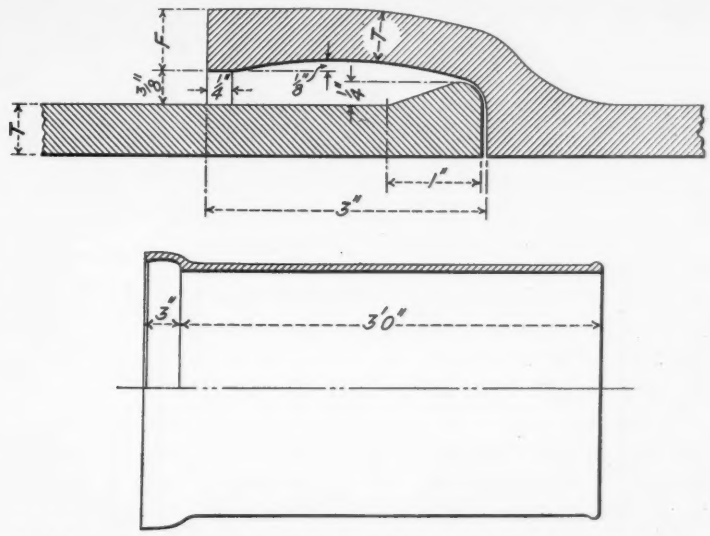
The annual meeting of the National Society for the Promotion of Industrial Education is to be held at Chicago on Thursday, Friday and Saturday, January 23, 24 and 25. It will begin with a public dinner at 6.30 p.m. on January 23 at the Auditorium Hotel, where the speakers will discuss the aims of the society and industrial education as an essential factor in national prosperity. The next day there will be public meetings at the Art Institute. The subjects of addresses and discussions include: The Apprenticeship Systems as a Means of Promoting Industrial Efficiency; The Place of a Trade School in Industrial Education and the Wage Earners' Benefit from Industrial Education. On Saturday morning the subject before the public meeting will be, A True Ideal of the Public School System that Aims to Benefit All. The afternoon will be taken up with business meetings of the society. C. R. Richards, Columbia University, New York, is Secretary; his address after January 20 will be the Auditorium Hotel, Chicago.

Cast Iron Culvert Pipe in 3-ft. Lengths.

The American Casting Co., Birmingham, Ala., is putting on the market a new design of cast-iron pipe for culverts. The cast-iron pipes usually used for this purpose are the ordinary water main sections which are of unwieldy lengths and unnecessarily heavy for culverts, the internal pressure in a culvert being so much less than that in a water main. The pipe made by the above company is furnished in 3-ft. lengths, with dimensions and weights as follows:

	Thickness of pipe, T.	Face of hub, F.	Weight, per ft.
Diameter of pipe, 12-inch.	7/16-in.	9/16-in.	60 lbs.
" " " 14-inch.	7/16-in.	9/16-in.	70 "
" " " 16-inch.	1/2-in.	5/8-in.	90 "
" " " 18-inch.	1/2-in.	5/8-in.	105 "
" " " 20-inch.	1/2-in.	5/8-in.	120 "
" " " 24-inch.	9/16-in.	11/16-in.	160 "
" " " 30-inch.	5/8-in.	3/4-in.	220 "
" " " 36-inch.	11/16-in.	13/16-in.	300 "
" " " 42-inch.	3/4-in.	7/8-in.	380 "
" " " 48-inch.	13/16-in.	15/16-in.	460 "

The accompanying drawings show longitudinal sections of the whole pipe and of the joint. The bell is 3 in. deep and the inside diameter at the face of the hub is 1/4 in. larger than the outside diameter at the thickest part of the spigot. The short 3-ft. lengths of pipe, besides being easily handled, render the culvert quite flexible and by the enlargement of the inside diameter of the middle of the bell still further flexibility is secured. This design gives enough clearance for assembling, yet requires but a small amount of lead or cement



Cast-Iron Culvert Pipe, Showing Detail of Bell and Spigot.

for calking and frequently makes any calking unnecessary. In connection with culverts, the following table of estimated areas which certain sizes of pipe with given fall will drain of storm water is of interest:

Diameter of pipe.		Fall per 100 feet— 1 in.	2 in.	3 in.	6 in.	9 in.	12 in.	24 in.	36-in.
12 in.	Acres—	1	2	3	4	5	6	8	10
14 "	"	2	3	4	6	8	10	13	16
16 "	"	3	4	5	7	9	12	16	22
18 "	"	4	5	6	8	10	13	20	30
20 "	"	6	8	10	12	16	20	30	45
24 "	"	10	12	15	20	25	30	45	60
30 "	"	20	25	30	45	60	75	100	160
36 "	"	40	50	60	75	100	130	200	280
42 "	"	60	80	100	125	150	200	300	400
48 "	"	80	100	120	150	200	260	400	560

Abolition of Grade Crossings on the Pennsylvania.

While invariably avoiding grade crossings on new work, the Pennsylvania has in the last five years been eliminating crossings at grade at many other places. On Jan. 1, 1902, there were 994 grade crossings on the lines of heaviest traffic between New York and Washington, and Philadelphia and Pittsburgh; but in the six years since then 568 of these—or more than half—have been abol-

ished. The completion of the new Washington terminal marks the consummation of the plan of the late President Cassatt to eliminate all grade crossings in the important cities between New York and Washington. This has involved the elevation or depression of tracks in Jersey City, Newark, Elizabeth, New Brunswick, Trenton, Philadelphia, Chester, Wilmington, Baltimore and Washington. Out of 101 grade crossings between Altoona and Harrisburg on Jan. 1, 1902, only 51 remained on the first day of this year. These figures take no account of the extensive and costly revisions of grade—so conspicuous in Philadelphia—whereby tracks for trains in different directions have been either elevated or depressed, thereby eliminating the necessity for trains to cross tracks at grade. This has been an important factor of safety at places where traffic is dense.

A Forty-Yard Blue Print.

The accompanying photograph shows a blue print 54 in. wide and 120 ft. long recently made on an Everett-McAdam continuous

Blue Print 120 Feet Long.

electric blue printing machine manufactured by the Revolute Machine Company, New York. This print was made on a single sheet of paper.

In Reduced Circumstances.

The Nantucket Central, the smallest railroad in New England, has installed gasolene motor cars, and will send back to the Boston, Revere Beach & Lynn the little narrow gage locomotive that has been its motive power for many years. The line is 8.50 miles in length, and its yearly mileage has been 6,500 miles. Now there will be that boon that Nantucket island people never enjoyed before —winter service between Nantucket and Siasconset.

The first of the new cars arrived the other day. It is a small affair, capable of carrying nine persons. Two larger cars will be constructed for summer use to carry 35 persons each. It is planned to construct a turnout at the four-mile marker so that trains may leave Nantucket and Siasconset simultaneously and pass each other. The trains will stop wherever signaled to allow passengers to board. Hereafter the force will probably consist of one baggage master, in charge of the baggage car, two or three motormen (as traffic requires), and a master mechanic. Hitherto there has been a coal bill of $500 annually. This will be materially reduced. Another plan is the extension of the track down Steamboat wharf as far as the freight house. This will bring close connection with the steamboat trade.—*Boston Herald.*

TRADE CATALOGUES.

A California Hydro-Electric Plant.—Bulletin No. 2,027 of the Allis-Chalmers Co., Milwaukee, Wis., entitled "The Hydro-Electric Plant at Trinity River, California," gives information on an interesting power transmission system. This plant has been built with an eye to future, rather than present, needs of the communities which it serves. It is in the central part of Trinity county, California, two miles below Junction City, where Canon creek, which supplies the water power, flows into Trinity river. The drainage area is 52 square miles. The dam, which is small, serves only to divert the water. In the system are 5,250 ft. of ditches and open flumes and a 1,821-ft. tunnel. An effective head of 600 ft., or a working pressure of 260 lbs. per sq. in., is obtained from two penstocks, each 1,165 ft. long. The power house is equipped with Allis-Chalmers electrical machinery, consisting of two three-phase, 25-cycle, 750-k.w., 500-r.p.m., 2,200-volt generators; seven step-up transformers, and auxiliary apparatus. The description of the plant is quite complete and will be of interest to engineers and students.

Band-Saw Tools and Sharpeners.—The Rotary File & Machine Company, Brooklyn, N. Y., has issued a booklet describing band-saw filing, setting, brazing and sharpening machines. The Ideal band-saw sharpener is a new machine just being put on the market. It is similar to the New Reliable power machine, but is worked by hand and is designed for filing small band-saws up to 1½ in. wide with teeth spaced ½ in. apart. The saw is gripped by a vice firmly enough to hold it while each tooth is being filed, yet allowing it afterward to slip along into position for filing the next tooth. At each revolution of the file shaft the file is automatically withdrawn from the tooth, the saw is moved along and the file engages the next tooth. It is easily adjusted to take different sizes and the cutting depth is controlled by cams.

Speed Indicator.—Harry Vissering, Chicago, has published a pamphlet describing the Hausshälter speed, time and distance indicator and recorder for locomotives and cars. This apparatus has been used in Europe for the last eight years. It indicates and records speed at all times up to 100 miles an hour, and also records the time of stops and time between stops, the total time that the train stands still between terminals, the time of delays and distance from the terminal where the delay occurred, the time of acceleration from stop to any speed and vice versa, distance between stations or stops and the total length of run. Line drawings show the construction of the device and its application to cars and locomotives.

Suction Gas Plants.—A pamphlet issued by R. D. Wood & Co., Philadelphia, Pa., is devoted to suction gas power plants. This system is designed particularly for prime movers from 40 to 300 h.p. The pamphlet gives tables comparing the relative net efficiency of steam engine and gas engine based on the original heating power per pound of coal. Other tables show the comparative consumption and fuel costs of different types of reciprocating and turbine steam engines, of gasolene, oil and gas engines and of the gas engine with suction producer. There are also some interesting results of tests. The illustrations consist of line drawings and half-tones of suction producer plants.

Small D. C. Generators.—Bulletin No. 93 of the Crocker-Wheeler Co., Ampere, N. J., is devoted to small engine type d.c. generators. These range in size from 25 k.w. to 150 k.w. The bulletin is illustrated with half-tones showing the motor and certain parts; rating and speeds of the different sizes are given in a table. Bulletins Nos. 91, 92 and 94 take up, respectively, induction motor panels; combined generator and feeder panels for direct current of from 125 to 250 volts; and switchboard panels.

Boilers.—A pamphlet of the Rust Boiler Co., Pittsburgh, Pa., is mostly taken up with full reports of two evaporation tests made by William Kent, Mem. A. S. M. E., of a 335-h.p. Rust boiler. The tests show between 10.8 and 12.2 lbs. equivalent evaporation per pound of combustible and from 69.2 to 75.9 per cent. efficiency of boiler based on combustible. The fuel used was Pittsburgh bituminous coal. The rest of the pamphlet illustrates and describes the Rust boiler.

Fans.—The Massachusetts Fan Co., Watertown, Mass., has just issued an additional section of its perpetual catalogue. This section is 16 pages and is entitled "Vertical and Horizontal Engines for Fan Driving." It is illustrated and gives descriptions, dimensions and horse-power tables. Previous sections of the catalogue relate to blowers and exhausters, heating, ventilating, drying and mechanical draft apparatus, etc.

Paint.—A recent issue of *Co-operation and Expansion*, published in the interests of the Heath & Milligan Co., Chicago, contains two interesting addresses on paint legislation, suggestions to sales agents, figures showing the growth in the number of establishments, capital invested and value of product of the paint manufacturers in the country, and news notes of interest to agents.

Reinforced Concrete.—The Atlas-Portland Cement Co., New York, has published a 249-page pamphlet entitled "Reinforced Concrete in Factory Construction." It gives general data on factory construction and design, with one chapter on concrete aggregates, and then goes into more detail in descriptions of 10 individual buildings. It is profusely illustrated with photographs.

Portable Industrial Railways.—The Arthur Koppel Co., Pittsburgh, Pa., is distributing a pamphlet devoted to portable indus-

trial railways. It gives dimensions, weights, etc., of types of dump and platform cars of various gages, and the weight of 15-ft. sections of track with different gages and rail sections. There are numerous photographs of installations.

Oil Storage.—Bulletin No. 4,002 of S. F. Bowser & Co., Fort Wayne, Ind., describes the Bowser system of oil storage as adapted to railroad storehouses and signal towers. It describes in detail the construction of the tanks, dumps and accessories, and is illustrated with half-tones showing parts and complete installations on several roads.

Catenary Line Material.—Bulletin No. 4,538 of the General Electric Co., Schenectady, N. Y., describes the catenary system of line conductors for high tension a.c. electric traction. The bulletin also describes designs of frogs, crossings, hangers, etc., and separate parts. It is illustrated with numerous half-tones of installations and auxiliary devices.

Thermit.—A folder issued by the Goldschmidt Thermit Co., New York, briefly describes the process of welding broken motor cases with thermit. A matrix of yellow wax is shaped about the fracture and the sand mold built about this as a pattern. The wax is then burnt out with a gasolene torch and the weld made as usual.

Storage Batteries.—Bulletin No. 8 of the Gould Storage Battery Co., New York, describes the two storage battery plants on the Dayton & Western, an interurban line. Bulletin No. 9 is devoted to storage batteries on alternating current systems and describes the plant on the Rutland Railway, Light & Power Co.

"*Off for California.*"—One of the most attractive publications for the California season yet received is that of the Chicago, Milwaukee & St. Paul, with the above title. It is printed in colors, with artistic half-tone illustrations. There is a map of the system and a schedule of the "Overland Limited."

The Valve World.—The December issue of this organ of the Crane Company, Chicago, gives in full a paper on Education for Mechanics, read by President R. T. Crane at a recent meeting of the Western Railway Club. Correspondence between Mr. Crane and Andrew Carnegie on this subject is included.

United of Havana.—A recent folder entitled "Cuba: Its Battlements and Bowers," maintains the standard set by the passenger department in previous publications. Nearly all the photographs reproduced are new and well adapted to attract the attention of prospective tourists.

Belts and Ropes.—The Cling Surface Co., Buffalo, N. Y., has issued a pamphlet entitled "The Treatment of Belts and Ropes for Service and Profit." It goes at length into methods of using Cling surface on many different types of belts and ropes under various conditions.

Illinois Central.—A recent folder issued by the passenger department is designed to point out the interest and comfort of the trip to Cuba via New Orleans. It describes, with attractive illustrations, the sea voyage and Havana and other Cuban cities.

Rail Chairs.—T. H. Symington, Baltimore Md., is distributing a circular showing a drawing and perspective view of Gilchrist rail chairs of two types: one for light work on electric lines and the other for heavy work on both electric and steam lines.

Frogs, Switches and Crossings.—The Indianapolis Switch & Frog Co., Springfield, Ohio, is distributing a portfolio consisting of perspective views and drawings of many styles of switches, frogs and crossings, including parts and accessories.

Tie Plates.—The Spencer Otis Co., Chicago, has issued a pamphlet illustrating the Economy rolled steel flange tie plate. Several types of this and other plates are shown.

MANUFACTURING AND BUSINESS.

Fritz von Hiller has been appointed representative at Mexico City of the Pressed Steel Car Co., Pittsburgh, Pa., succeeding D. G. Farragut, resigned.

An organization in western Europe wants to get in touch with makers of pressed steel fire bars. For address, apply to the Bureau of Manufactures, Washington, D. C., mentioning file number 1,829.

A. E. Robbins has resigned from the Gold Car Heating & Lighting Co., New York, to go to the Ward Equipment Co., 141 Broadway, New York. His position in the latter company will be prominent; the title is as yet undecided, as the details of organization are not fully worked out.

The Erie has arranged to have some locomotives repaired by the American Locomotive Co., New York, but has not made any definite contract as to the number of engines. The Baldwin Locomotive Works, Philadelphia, Pa., has been for some time repairing about one locomotive a day for the Erie.

During 1907 the Baldwin Locomotive Works, Philadelphia, Pa., built 2,663 locomotives, of which 363 were for export. The total output includes 2,371 steam locomotives and 292 electric locomotives. Of the steam locomotives, 40 were Mallet compounds. The average weekly payroll amounted to 18,665 men.

F. K. Rhines has been made Assistant to the Treasurer and General Manager of the General Fireproofing Co., Youngstown, Ohio. Mr. Rhines was formerly Engineer with the East Iron & Machine Co., bridge builders, at Lima, Ohio, and more recently has been Chief Engineer and General Manager of the Dixon Engineering & Construction Co., Toledo, Ohio.

The new factory of the Glidden Varnish Co., Cleveland, Ohio, is completed and in full operation, and the old factory, the home of the company since 1874, is idle for the first time in its history. The new plant has been a year and a half in building and cost over $500,000. It covers 17 acres and the buildings are of brick, concrete and steel. It is said to be the largest and most perfectly appointed exclusive varnish factory in the world both in manufacturing and storage facilities. There also is a large grinding department.

Beginning Jan. 1, 1908, the sales departments of the Western Tube Co., Kewanee, Ill., and the Shelby Steel Tube Co., Pittsburgh, Pa., will be consolidated with the sales department of the National Tube Co., Pittsburgh, Pa. The new sales organization will be as follows: Edward Worcester, First Vice-President and General Manager of Sales; James W. Downer, John Duncan and H. S. White, Assistant General Managers of Sales, all with offices at Pittsburgh. Instead of five local sales offices, there will be nine, as follows: New York, Battery Park building, Clifton Wharton, Jr., Manager of Sales, with sub-office in the Pennsylvania building, Philadelphia, Pa.; Pittsburgh, Pa., Frick building, A. M. Lally, Manager of Sales; Chicago, Commercial Bank building, H. S. Raymond, Manager of Sales; St. Louis, Mo., Chemical building, E. A. Downey, Manager of Sales; San Francisco, Cal., Crocker building, George S. Garritt, Manager of Sales, Thos. W. Brooks, Assistant Manager of Sales; Portland, Ore., R. R. Hoge, Manager of Sales, with sub-office at Seattle, Wash.; Denver, Colo., Majestic building, Edwin H. Fowle, Manager of Sales; New Orleans, La., Hugo Weidmann, Manager of Sales, and Atlanta, Ga., Candler building, Edward Worcester, Jr., Manager of Sales.

Iron and Steel.

The Chicago, Milwaukee & St. Paul has bought 2,200 tons of bridge steel.

The Pittsburgh & Lake Erie is reported to be in the market for 16,000 tons of bridge steel for a bridge at Beaver, Pa.

OBITUARY NOTICES.

Frank L. Palmer, formerly and for about 30 years connected with the passenger department of the Wabash, died suddenly at his home in Chicago, January 11, at the age of 65. Mr. Palmer resigned the office of Assistant General Passenger Agent about three years ago.

Henry F. Kenney, formerly and for many years Superintendent of the Philadelphia, Wilmington & Baltimore, died on January 10 at his home in Ridley Park, near Philadelphia, at the age of 73. Mr. Kenney continued in charge of the P., W. & B., and also of the Baltimore & Potomac after they came under control of the Pennsylvania, and he retired from active service only a few years ago. He remained President of the Delaware Railroad, a part of the system, up to the time of his death.

George F. Evans, Vice-President and General Manager of the Maine Central, died suddenly at Vanceboro, Me., January 10, while on a tour of inspection. Mr. Evans was about 60 years old. He was born at Concord, N. H. His first railroad service was on the Louisville, Evansville & St. Louis, where he began in 1881 as Secretary and Treasurer and rose to be General Manager. In 1892 he left that company to go to the Boston & Maine, where he was for three years Superintendent of the Southern division. Then for a year he was Assistant General Manager, and on December 1, 1896, was appointed to the position on the Maine Central (controlled by the Boston & Maine), which he held at his death. He was also Vice-President of the Washington County Railway.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

New York Railroad Club.

At the meeting of this club to be held in the building of the United Engineering Societies, No. 29 West 39th street, on Friday, January 17, a paper on "The Era of Steel and the Passing of Wood in Car Construction," by Arthur M. Waitt, will be read. W. R. McKeen (Union Pacific), and G. R. Henderson, of New York, will participate in the discussion.

Western Railway Club.

At the January meeting, to be held in the Auditorium Hotel, Chicago, on Tuesday, the 21st inst., at 8 o'clock p.m., the paper on "Ventilation and Heating of Coaches and Sleeping Cars," by S. G. Thompson, Assistant Engineer of Motive Power, Pennsylvania Railroad, postponed from the December meeting, will be presented; also a paper on "The Car Wheel and Its Relation to the Rail and Car," by S. P. Bush, Vice-President and General Manager of the Buckeye Steel Castings Co., Columbus, Ohio.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Chicago River & Indiana.—The President of this company is H. T. Gilbert; Vice-President and Treasurer, Frank Donnelly; office of both at Chicago.

Pennsylvania State Railroad Commission.—Governor Stuart on January 13 announced the appointment of the three members of the new State Railroad Commission, authorized under the law which went into effect January 1. The Chairman is Nathaniel Ewing, now Judge of the United States District Court in Western Pennsylvania, and formerly counsel for the Pennsylvania Railroad and other corporations. He is appointed for a term of five years. He is 60 years old. The second member is Charles N. Mann, of Philadelphia, clerk in the office of the prothonotary of Philadelphia county, 70 years old, appointed for four years. The third member is John Y. Boyd, of Harrisburg, retired; 45 years old. Mr. Boyd was formerly connected with anthracite coal companies on the line of the Pennsylvania Railroad.

Seaboard Air Line.—The United States Circuit Court has appointed E. C. Duncan, of Raleigh, N. C., as a third Receiver of this road.

Operating Officers.

Ann Arbor.—Eugene Hertenstein has been appointed Superintendent at Owosso.

Chicago Great Western.—C. S. Weston has been appointed Superintendent of the Southwest division, with office at Des Moines, Iowa, in place of C. L. Nichols, resigned. C. T. Banks has been appointed Superintendent at Red Wing, Minn.

Chicago River & Indiana.—D. L. Phipps is General Superintendent and T. P. Convey Car Accountant; offices at Chicago.

Cleveland, Cincinnati, Chicago & St. Louis.—A. A. Hyatt has been appointed Trainmaster on the Cairo division, in place of T. J. Hayes.

Coahuila & Zacatecas.—P. E. O. Carr has been appointed General Manager, with office at Saltillo, Mex.

Lake Shore & Michigan Southern.—J. M. Horgan, heretofore Trainmaster, has been appointed Assistant Superintendent of the Franklin division.

Engineering and Rolling Stock Officers.

Atchison, Topeka & Santa Fe.—J. H. McGoff, heretofore Master Mechanic at Fort Madison, Iowa, has been appointed Mechanical Superintendent of the Eastern Grand division, with office at Topeka, Kan.

International & Great Northern.—J. F. Enright has been appointed Superintendent of Motive Power, with office at Palestine, Tex. See Mobile & Ohio.

Mexican.—W. T. Ingram, heretofore Engineer of Maintenance of Way on the Interoceanic, has been appointed Superintendent of Permanent Way, in place of T. A. Corry; office at Mexico, Mex.

Missouri Pacific.—J. L. Butler has been appointed Master Mechanic at Atchison, Kan., in place of L. J. Mills.

Mobile & Ohio.—E. G. Brooks has been appointed Master Mechanic of the Mobile division at Whistler, Ala., in place of J. F. Enright, who has resigned. Mr. Brooks also holds the title of Master Mechanic of the Southern Railway in Mississippi.

Tonopah & Goldfield.—E. S. Van Housen has been appointed Chief Engineer of this road and of the Bullfrog-Goldfield Railroad.

LOCOMOTIVE BUILDING.

The Imperial Copper Co. of Oregon has ordered one locomotive from the Hicks Locomotive & Car Works.

The Smith & Powers Logging Co., of Oregon, has ordered one locomotive from the Hicks Locomotive & Car Works.

CAR BUILDING.

The Stanley, Merrill & Phillips Ry. has ordered 25 flat cars from the Hicks Locomotive & Car Works.

The Canadian Pacific has ordered 400 composite steel and wood freight and ballast cars from the Dominion Car & Foundry Co.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Arkansas, Louisiana & Gulf.—This company's projected line is from Monroe, La., on the St. Louis, Iron Mountain & Southern and the Vicksburg, Shreveport & Pacific, north across the Louisiana-Arkansas state line to Pine Bluff, Ark., with a seven-mile branch to Crossett, Ark., on the Chicago, Rock Island & Pacific, in all 143 miles. It has made a mortgage, of which the Colorado Title & Trust Company, of Colorado Springs, is trustee, securing $6,000,000 5 per cent. gold bonds. Of these, $2,860,000 are to be issued at the rate of $20,000 a mile on the 143 miles now projected, and the remaining $3,140,000 reserved for future extensions. The road has been built from Monroe, La., north to Bastrop, 28 miles, and grading is finished 28 miles further to Hamburg, Ark., and also on the branch to Crossett. Track-laying is in progress on these lines. The 80-mile further extension from Hamburg to Pine Bluff has been surveyed. The company has already received equipment both for operating the completed lines and for carrying on the construction work. J. M. Parker is General Manager of the Southern Development Company, which is building the road.

Arkansas, Oklahoma & Western.—See this company under Railroad Corporation News.

Atlanta, Birmingham & Atlantic.—Work is now under way on an extension of this company's line from Talladega, Ala., west to Birmingham, 75 miles, and on that from Bessemer, Ala., to Mulgay, 14.5 miles. The contractors are the Lane Bros. Company, Atlanta, Ga., and C. D. Smith & Co., Birmingham, Ala.

The company is making surveys for a line from Atlanta, Ga., southwest to New Orleans, approximately 500 miles.

Atlanta, Norcross & Gainesville.—Incorporated in Georgia to build a line from Atlanta northeast to Gainesville, about 50 miles. The incorporators include: H. D. Jaquish, C. C. Sanders, W. B. Smith, J. H. Hunt, R. Smith, A. J. Mundy, H. B. Smith, M. M. Ham, J. W. Bailey, H. H. Dean and J. L. B. Stevens, all of Hall county.

Canadian Northern Ontario.—Work is now under way on a line to Key Harbor, on Georgian Bay, about six miles, to carry iron ore from the Moose Mountain deposits.

Charlotte Harbor & Northern.—This company, which last year built 37 miles of railroad in Florida, is building with its own men a three-mile line known as the Hull cut-off to Hoist No. 7. The company is planning to build an extension from Arcadia to Plant City, 60 miles.

Chattahoochee Valley.—This company, it is said, has filed plans for an extension from West Point, Ga., north through Troup county, Ga., to Standing Rock, in Chambers county, Ala., thence to a point near Texas in Heard county, Ga.

Chicago & Milwaukee (Electric).—This company last year built 38 miles of electric line as follows: From Racine, Wis., toward Milwaukee, 34 miles, and four miles in Milwaukee. Work is now under way by the MacArthur Bros. Co., on the remaining six miles to Milwaukee; also on 3½ miles additional in Milwaukee.

Chicago, Milwaukee & St. Paul.—It is said that this company expects soon to begin operating its Pacific extension from the Missouri river west to Marmath, Mont., 200 miles. The line is now in operation from the Missouri river west to Bowman, N. Dak., 163 miles. Most of the grading between this point and Butte, Mont., is finished, and it is expected to have the line in operation west to Butte about June 1.

Cumberland River & Nashville.—Contracts have been given to the Monticello Construction Company, of Monticello, Ky., for building this proposed line from Burnside, Ky., southwest to Monticello, 20 miles; graded for 12 miles. The line is projected from Corbin, Ky., west to Burnside, and thence southwest to the Tennessee state

line, 100 miles. S. Woodward, President, Carlisle building, Cincinnati, Ohio.

DANSVILLE & MOUNT MORRIS.—This company has projected a line to be built under the name of the Hornell & Dansville from Dansville, N. Y., south to Burns, 10 miles.

DENVER, NORTH-WESTERN & PACIFIC.—This road, building from Denver, Colo., west to Salt Lake City, Utah, 500 miles, is now in operation to Yarmony, Colo., 147 miles. Contract has been let to Orman & Crook, of Denver, for the section from Yarmony to Steamboat Springs, 6.8 miles, leaving 340 to be built to finish the line to Salt Lake City. A contract was recently signed by which 2,000 men will be put to work to finish the line to Salt Lake City as rapidly as possible. A company has been formed by D. C. Dodge, Charles Boettcher, Thomas F. Walsh, of Washington; C. Phipps, of Pittsburgh, and H. M. Porter to push the work.

DENVER & TRANSCONTINENTAL.—This company, it is said, has stopped making surveys for its proposed line from Denver, Colo., southwest to the Pacific coast.

FLORIDA EAST COAST.—The extension of this road from Homestead, Fla., southwest along to Florida Keys, Key West, 126 miles, is reported opened for traffic south to Knight's Key, 66 miles. From Key West north track has been laid on about 15 miles.

FOURCHE RIVER VALLEY & INDIAN TERRITORY.—Location surveys have been made by this company from the present end of track to the west line of Perry county, Ark., 38 miles. An officer writes that the company has stopped work until times are easier. (March 15, p. 384.)

GRAND TRUNK PACIFIC.—Contract has been let to Foley Bros. & Larsen, of Winnipeg, for building from a point six miles east of Edmonton, Alb., to Wolf Creek, 120 miles west. The section will be the most expensive of any so far under contract, the cost being estimated at between $40,000 and $50,000 per mile. On the Lake Superior branch, which is being built by the same firm, there is some difficult engineering and it is not expected that the road between Winnipeg and Port Arthur can be finished before the latter part of 1910. About 100 miles was built last year on this section. Tenders have been asked for building a 100-mile section in British Columbia from Prince Rupert east.

GULF, COLORADO & SANTA FE.—Contract has been given to John Scott & Sons, of St. Louis, Mo., for building a connecting line from Center, Tex., to Zuber, on the Texas & Gulf, 21 miles.

HILLSBORO & NORTHEASTERN.—This company has projected an extension from Hillsboro, Wis., south to Richland Center, 28 miles.

HORNELL & DANSVILLE.—See Dansville & Mount Morris.

IDAHO & WASHINGTON NORTHERN.—This company is building with its own men an extension from Grand Junction, Idaho, to McGuires, 1.3 miles.

INDIAN CREEK VALLEY.—This company has location surveys made for an extension from Jones Mills, Pa., about 10 miles. C. F. Hood, President, Normalville, Pa.

LAKE SUPERIOR & ISHPEMING.—Surveys are being made for a change of main line through Negaunee, Mich., about three miles; also for reducing the grade on a five-mile mining branch and to extend this branch three miles. The work, which will be heavy, is being done on account of prospective caving ground at the mines. It will necessitate the building of a number of steel bridges.

LARAMIE, HAHNS PEAK & PACIFIC.—This company has location surveys made and is about ready to lay tracks on an extension from Centennial, Wyo., south to Hebron, Colo., 77 miles; 33 miles will be in Wyoming and 44 miles in Colorado. Grading has been finished on about six miles.

MEXICAN CENTRAL.—Grading is reported finished on about 40 miles on the line this company is building from Apulco to Tamos, and track laying on this section is shortly to be started. Work is under way on a bridge over the Panuco river. Connection is to be made at Tamos with the Tampico-Aguascalientes branch, which is 25 miles from Tampico. The line is now in operation from Mexico City to Apulco, and when the entire work is finished will furnish a short and direct route from Mexico City to Tampico.

MEXICAN ROADS.—Plans are being made by Robert S. Towns and associates, who own large smelting interests in Mexico, to build a line from Gutierrez, on the Mexican Central, to the Sombrete mining district in the state of Zacatecas, about 100 miles. Final location surveys for most of the way have been made, and construction work, it is said, will soon be started.

A concession is shortly to be granted by the Mexican Government for a line from Comacho, Zacatecas, where a connection is to be made with the Mexican Central to Bonanza, about 100 miles. The names of the projectors are not given.

MINGO & MONONGAHELA.—Surveys made by this company for a line from the mouth of Mingo creek, Pa., northwest to Thomas on the Wheeling branch of the Baltimore & Ohio, 11 miles. C. McK. Watts, President, Elizabeth, Pa.

MISSOURI SOUTHERN.—Contracts let to the S. H. R. Robinson & Son Contracting Company, of St. Louis, Mo., for an extension from Ohlman, Mo., to Bunker, eight miles. The company has projected a further extension from Bunker to Salem, 20 miles.

MONTANA RAILROAD.—Contract has been given to Dittner, Bradbury & Co., of Lombard, Mont., for rebuilding this line from Lombard, Mont., east to Minden, 36 miles. Surveys also made from Minden north to Summit, 14 miles.

NEVADA COUNTY NARROW GAGE.—Contract let to Horan Bros., of Grays Valley, Cal., for building a line from Coleman Station to Long Ravine, 3½ miles.

NEW YORK SUBWAYS.—The necessary consent of property owners has been obtained by the Interborough Rapid Transit Company for its proposed improvements at Broadway, 96th and 102d streets. Three additional tracks are to be laid to make a more convenient junction. (Aug. 23, p. 215.)

PACIFIC & EASTERN.—Surveys are being made by this company for an extension from Eagle Point, Ore., to Butte Falls, 21 miles.

PITTSBURGH, BINGHAMTON & EASTERN.—Location surveys have been made for extending this line from Cedar Ledge, Pa., to Clearfield, 141 miles, of which 21 miles from Cedar Ledge to Powell were built last year. The Holbrook, Cabot & Rollins Corporation, Boston, Mass., are the contractors.

RANDOLPH & CUMBERLAND.—An officer writes that this company has temporarily stopped work on its extension from Hallison, N. C., northeast to Tillman, 3½ miles. Grading has been finished.

SAN FRANCISCO, IDAHO & MONTANA.—Contract has been given to the Congon Construction Company, of Caldwell, Idaho, for building this line from Caldwell, Idaho, to Homedale, 16.2 miles, and work is now under way. Surveys made from Homedale to Winnemucca, Nev., 275 miles. Address F. H. Richardson, Caldwell.

STEPHENVILLE NORTH & SOUTH TEXAS.—This company has projected an extension of its line from Stiegler, Tex., north for 38 miles, and from the southern end of the line at Hamilton, south 60 miles.

TEXAS STATE.—This road, in operation from Rusk, Tex., west 10 miles, is owned by the state. It is to be extended west 18 miles to Palestine; also from the eastern terminus at Rusk east to a connection with the Southern Pacific, six miles. Plans, it is said, are being made to extend the road from Palestine northwest to Dallas, Tex., 100 miles, and on the southern end southeast to Sabine Pass, on the Gulf coast, about 160 miles from Rusk. (April 26, p. 600.)

TORONTO, HAMILTON & BUFFALO.—Contract has been given by this company to Anderson & Goodale, of Hamilton, Ont., for building the Westinghouse spur to the city of Hamilton, Ont., 1.26 miles.

TREMONT & GULF.—This company, which now operates a line from Tremont, Tex., south to Winnfield, 50 miles, with a branch from the main line near its southern terminus at Menefee, northwest to Pyburn, 10.5 miles, is building an extension of this branch from the main line at Menefee southeast to Rochelle, 18 miles.

VAN'S HARBOR LAND & LUMBER COMPANY'S ROAD.—Work is progressing in the clearing of the right-of-way on a proposed logging road to be built from Van's Harbor, Mich., towards Cook's Mill, nine miles, and it is expected to begin grading early this spring. A further four-mile extension is projected to finish the line to Cook's Mill.

WATERLOO, PERLA & SOUTHWESTERN.—An officer writes that this company, which was incorporated last year to build a line from Waterloo, Iowa, southwest to Chariton, 120 miles, with about 20 miles of sidings, is making surveys and securing rights-of-way. Contracts will probably be let for building the entire line early this spring. E. A. Harris, Vice-President and General Manager, Pella, Iowa.

WHEELING & LAKE ERIE.—Referring to recent reports of improvements on this road, an officer writes the company has in contemplation a considerable amount of double tracking and minor grade and curvature reduction work and also the completion of the Sugar Creek & Northern, a new cut-off from Bolivar, Ohio, northwest to Orrville, 22 miles, which is now three-fourths finished. This cut-off line will save six miles in distance, and will do away with the only severe grades on the main line, also provide greatly improved yard and terminal facilities. This work, however, as well as all other improvement and betterment work, has been for some time suspended, and there is no early probability of its being resumed until the financial conditions are wholly changed.

WICHITA FALLS & NORTHWESTERN SYSTEM.—This company is

building with its own men an extension from Olney, Tex., south to Belknap, 14 miles.

RAILROAD CORPORATION NEWS.

Arkansas, Oklahoma & Western.—This company, formerly the Rogers Southwestern, has 30 miles in operation from Rogers, Ark., west to Siloam Springs, on the Kansas City Southern. An extension of 65 miles is projected from its western terminus to Pryor Creek, Okla., and an extension of 30 miles from its eastern terminus to Eureka Springs, Ark. Merriam, Smith & Co., of New York, are offering at par the first mortgage, 40-year 6 per cent. bonds of 1947 of this company. The issue of these bonds is limited to $10,000 a mile.

Baltimore & Ohio.—See Chicago Terminal Transfer.

Boston & Maine.—The Fitchburg Railroad has renewed for one year at 6 per cent. $500,000 5 per cent. notes which matured January 15. The new notes have been sold at par through R. L. Day & Company.

Chicago, Rock Island & Pacific.—This company has sold to Speyer & Company $3,000,000 first and refunding 4 per cent. 30-year bonds and has given that firm an option on $6,000,000 more of the bonds. The bonds are part of an issue of $55,592,000. It is not announced what use is to be made of the proceeds of this sale, but it is believed that the transaction is part of the plan for redeeming $6,000,000 4½ per cent. notes maturing April 1.

Chicago Terminal Transfer.—The stockholders' protective committee has issued a statement to the effect that it was the "alleged lease dated April 1, 1903, to the Baltimore & Ohio at the ruinously low rental of approximately $160,000 per annum which brought the Terminal Company to foreclosure, the property leased to the Baltimore & Ohio being worthy of a rental of not less than $600,000 per annum. The properties leased to the Baltimore & Ohio are among the most valuable owned by the Terminal Company." It was because of representations to this effect made by the committee at the time the Baltimore & Ohio applied to the Court for permission to pay the first mortgage bonds of the Terminal Company that the Court ordered that this action should be done without prejudice to the rights of the Chicago Terminal Transfer to contest the Baltimore & Ohio lease as fully and freely as if the Baltimore & Ohio had not been allowed to pay the first mortgage bonds.

Cripple Creek Central.—The quarterly dividends on the common and preferred stocks have been passed. The annual rates have been 4 per cent. on the preferred and 6 per cent. on the common. This action is taken because of losses which the company sustained in the recent failure of the banking firm of Kessler & Company.

Erie.—Net earnings for November, after taxes and equipment depreciation charges, decreased 68 per cent. Gross earnings were $4,294,239, a decrease of $341,996. Net earnings $449,644 against $1,418,816 in 1906, a decrease of $969,173. The gross earnings for the five months ended November 30 were $23,855,349, an increase of $1,024,667. Net earnings were $5,096,200, a decrease of $1,947,468.

Gulf & Ship Island.—All the lumber mills on the line of this road, many of which were closed during December, are in operation again. The road runs from Jackson, Miss., south to Gulfport.

Michigan Central.—The Turbine Steamship Company, of Buffalo, is reported to be negotiating to buy or lease the line of the Michigan Central extending from Fort Erie, along the western bank of the Niagara river, north to Niagara-on-the-Lake, 27 miles, as a connection for a line of turbine steamers from Niagara-on-the-Lake across Lake Ontario to Toronto.

Missouri Pacific.—This company has made application to the New York Stock Exchange to list $1,935,200 additional stock. This is to pay the regular semi-annual dividend of 2½ per cent. recently declared payable in stock.

Mohawk Valley.—The Rochester Railway & Light Company has declared the first dividend of 5 per cent. on its $6,500,000 common stock. The Syracuse Rapid Transit has declared the first dividend of 3 per cent. on its $2,750,000 common stock. Both companies are controlled by the Mohawk Valley Company, which in turn is controlled by the New York Central & Hudson River.

New York Central & Hudson River.—See Mohawk Valley Company.

New York Central Lines.—The expected issue of equipment trust notes has been announced. It consists of $30,000,000 5 per cent. 15-year notes maturing in equal annual instalments, beginning November 1, 1908. They are guaranteed jointly and severally by the New York Central & Hudson River, the Lake Shore & Michigan, the Michigan Central, the Cleveland, Cincinnati, Chicago & St. Louis and the Chicago, Indiana & Southern. J. P. Morgan & Company and Drexel & Company have offered them for sale at prices ranging from 93 for the instalment maturing in 1922 to 99¾ for the first instalment.

Northern Securities.—This company's income for the year ended December 31, 1907, amounted to $359,000, an increase of $94,000 over 1906. Its two principal sources of income are dividends on the stock of the Chicago, Burlington & Quincy Railroad and on the stock of the Crows Nest Pass Coal Company. During the year the company acquired 150 additional shares of Burlington stock and 2,067 additional shares of the Crows Nest Pass stock. The one remaining outstanding share of the company's original capital stock was also surrendered to it, thereby permitting the distribution of its former holdings of Northern Pacific and Great Northern shares to be completed.

Pennsylvania.—During the calendar year ended December 31, 1907, the shipments of coal and coke originating on the Lines East of Pittsburgh and Erie amounted to 58,457,932 tons against 49,711,088 tons in 1906. This is an increase of 8,746,844 tons, or 18 per cent.

Rogers Southwestern.—See Arkansas, Oklahoma & Western.

Seaboard Air Line.—Judge Pritchard, in the United States Circuit Court at Richmond, Va., on January 14, announced that as the two present receivers were representatives of two hostile interests, he would appoint a third receiver of the Seaboard Air Line, representing the United States Court and no other interest. Edward C. Duncan, of Raleigh, N. C., a director of one of the constituent companies of the Norfolk & Southern, was on January 15 named as third receiver.

Southern Pacific.—This company continues to report heavy decreases in net earnings. The average mileage operated in November was 9,483, an increase of 175 miles as compared with November, 1906. Gross earnings were $11,692,722, an increase of $539,430. Net earnings after taxes were $3,524,434, a decrease of $1,381,822. For the five months ended November 30, with 202 more miles operated than in the corresponding period of the previous year, gross earnings were $58,030,955, an increase of $7,492,816. Net earnings for the five months were $16,765,486, a decrease of $3,545,848. In explanation of the showing for November the following official statement is made:

"About $866,000 of the increase in expenses is for maintenance of way, structures and equipment. The continuous rains of the spring of 1907, lasting longer than ever before known since the construction of the lines, softened the roadbed of the entire mileage in the states of California, Nevada and Oregon, so that under the exceptionally heavy traffic the track deteriorated very rapidly, and it was found after temporary repairs necessarily put on the line were made, that practically all of this mileage had to be resurfaced, ballasted and retied, and these causes have affected expenses in every month of the present fiscal year. They have added $494,000 to the expenses, of which $320,000 was for roadbed repairs and $174,000 for renewal of ties. Renewals of equipment increased about $190,000, due to increases in wages and heavier repairs required. Expenses for conducting transportation increased $665,000. Of this increase $295,000 is due to the higher prices of coal and fuel oil and a larger consumption. The remaining expenses resulted mainly from an increase of 78,000,000 ton-miles, or about 11 per cent."

Toledo & Ohio Central.—The Ohio Savings Bank & Trust Company, of Toledo, is offering at a price to yield 6½ per cent. part of an issue of $500,000 4 per cent. car trust notes maturing up to 1818 of the Zanesville & Western, guaranteed by the Toledo & Ohio Central. These notes were issued for 500 steel underframe drop-bottom gondola cars of 100,000 lbs. capacity. The Toledo & Ohio Central owns the entire capital stock of the Zanesville & Western.

Toledo Terminal Railroad.—The reorganization plan of the Toledo Railway & Terminal Company has been declared operative by the bondholders committee. The new company is the Toledo Terminal Railroad.

Union Pacific.—The average mileage operated in November was 5,713 miles, an increase of 120 miles as compared with the figure for the corresponding period of 1906. The gross earnings for that month were $7,406,655, an increase of $806,132. Net earnings after taxes were $3,371,176, an increase of $64,055. With 93 miles increase in average mileage, gross earnings for the five months ended November 30 were $36,389,214, an increase of $4,114,764. Net earnings for the five months were $15,010,474, a decrease of $1,168,019.

Vandalia.—The $1,676,000 first mortgage 7 per cent. bonds of the Indianapolis & Vincennes, which mature February 1, 1908, are to be paid.

Zanesville & Western.—See Toledo & Ohio Central.